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Electricity in Factories

THE Annual Report of the Chief Inspector of Factories and Workshops is always full of interest. In the summary we give on a later page we have had, generally, to confine our attention to matters of a more directly electrical nature, but the other sections contain much that will appeal to all engineers concerned in production. Of these the chapter on the Home Office Industrial Museum is particularly noteworthy, proving as it does that example is a valuable ally to precept.

The total number of reported accidents in factories and workshops in 1930 decreased by nearly ten per cent. from the 1929 figures with an equivalent reduction in fatalities. This decrease is no doubt in part due to industrial depression, but it is significant, as Sir Gerald Bellhouse points out, that there has been a considerable reduction in accidents in those industries in which safety organisation has received most attention. Accidents due to electricity accounted for rather less than a quarter of one per cent. of the total, and about two and one-third per cent. of the fatalities. Considering the very extensive application of electricity throughout industry, these results provide striking indication of its relative safety.

Attention has frequently been drawn to the fact that carelessness in dealing with lower-voltage apparatus is responsible for most accidents. Nearly one-third of the electrical accidents occurred with switches, fuses, and motor control apparatus operating at less than 650 volts, mainly due to burns following short circuits. Portable lamps, although not contributing largely to the total number of electrical accidents, provided a disproportionately large number of fatal cases—no less than 30 per cent. of the total. Mr. Swann's suggestion that screw-cap lampholders should have skirts long enough to prevent the lamp screw from being touched while it remains in engagement with the holder is commendable, and, indeed, many manufacturers are prepared to supply types that fully comply with this desirable, though as yet unofficial, requirement.

The majority of accidents were experienced by non-technical persons. This was only to be expected, but the fact that electricians and other skilled men were involved in nearly one-third of the reportable cases is, we think, due to something more than their intimate connection with the work. Often it appears to be a case of familiarity breeding contempt, coupled with a failure to realise that the slipping of a screw-driver is nowadays likely to be accompanied by a very much more severe short-circuit than would have been the case a few years ago. The keeping of up-to-date records of short-circuit values at different points on their networks has now become an essential part of the duties of electricity supply undertakings, as consumers' switchgear suitable for its purpose when installed may prove with system developments to be no longer adequate to deal with the increased kVA liberated under fault conditions. The position is a difficult one, for, while factory owners are responsible for the employment of suitable switchgear, they may naturally feel that they should not bear the burden of replacements necessitated by system conditions over which they have no control.

It will seem strange to the older members of the indus-

try to come upon a " Report of the Senior Electrical Inspector " that does not appear over the name of Mr. G. Scott Ram, who made his first annual report as long ago as 1902. The best monument to his work is to be found in his constructive reports and in the admirable Regulations which he drafted in 1908 with a foresight indicated by the fact that their provisions, together with the lucid explanatory memorandum, still hold good; they have without doubt contributed very largely to the fact that the enormous expansion in the use of electricity during recent years has been accompanied by so slight an increase in the number of accidents. His successor, Mr. H. W. Swann, shows in the present document the clarity of outlook and lucidity of expression that we have come to look for in this long series of reports, as well as a total avoidance of bureaucratic self-sufficiency.

Grossly Exaggerated

In some of the daily papers of Monday last it was reported that during a severe storm the main transformer of the Yorkshire Electric Power Co. at Selby had been struck by lightning and wrecked. To ascertain the facts we communicated with the company and were informed that the Press reports were grossly exaggerated. The transformer was not damaged, and the personnel were not injured or endangered in any way. Electricity seems to be a useful journalistic standby when sensational happenings are scarce nowadays. If there is no murder to be " splashed," harassed sub-editors fall back on " pylons " or power stations emitting tons of grit and chemicals. Every fire must be " believed to have been caused by the fusing of an electric wire," and in any storm electric lines and apparatus blow up and are demolished. The electrical industry welcomes advertisement but unfortunately the kind of publicly usually afforded by the Press is hair-raising not load-building.

South Scotland

By its adoption of the scheme of the Electricity Commissioners for South Scotland, the Central Electricity Board has completed, with a relatively unimportant exception, its survey of the means of electrical interconnection in Great Britain. The exception is the thinly populated Highlands, the most important electrical feature of which is the existence of some considerable water power stations; these, however, form part of the supply arrangements for the Central Scotland Area. The South Scotland Area also has notable water-power resources, and 102,000 kW installed in five stations will constitute the bulk of the generating plant under the present scheme. An interesting point here is that the grid will absorb the electricity produced in Galloway as and when available, thus avoiding the heavy expenditure on civil engineering works that would be entailed if such stations were isolated units. Particulars of the South Scotland scheme were given in our issue of January 16th last. It will be noted that the C.E.B. has accepted the suggestion of the Commissioners that Galashiels should be connected with Dunston. The expenditure on this line, if debited to the South Scotland scheme, will make it the first of the nine schemes that will not be self-supporting, but the benefit to the grid, as a whole, of this connection surely justifies its inclusion.

The New Cable Press

The Henley straight-through cable lead-sheath press described this week is a development of outstanding importance which will have far-reaching results, and considering that the older method of lead-sheath production has remained practically unchanged since its introduction 40 or so years ago, the non-weld sheath is long overdue. Nevertheless, it would not be very difficult, out of favourable impressions gained of the new press, to create something in the nature of a scare with regard to the old method of production. The weakness of the longitudinal weld in the ordinary cable sheath is relative—the weak point of a good job. It is very rarely that trouble is caused by the weld, and there are many thousands of miles of cable that have stood the test for a few decades. Submarine-cable users will no doubt particularly welcome the development, and the " weldless " cable should prove of very great value for installations where there is much vibration—over bridges, &c.

Lighting and the Two-part Tariff

The beneficial effect of a two-part tariff with a low secondary rate on the development of the domestic power and heating load has been frequently emphasised, but not so much has been heard of the modification in the characteristics of the lighting load due to the same cause. At 4d. or 5d. per kWh it is worth while to pay some regard to economy in the use of electricity for lighting; at ½d. to 1d. (the fixed charge having to be met in any case) it makes very little difference to the quarter's bill if a switch is left on when not strictly necessary or if the candle power of the lamps is on the lavish side. We have known of cases in which the lighting consumption has gone up by nearly 50 per cent. after a change over to a two-part tariff. It is probably only conservatism that stands in the way of a general use of porch or gateway lighting for residences. It would certainly be very useful and a 25-watt lamp would cost only two shillings or three shillings a year for electricity. This suggestion is put forward in a new handbook (No. 4A) " Home Lighting," issued by the E.L.M.A. Service Bureau, which gives in a brief space some very useful information for the assistance of those interested in good domestic illumination. We are quite in agreement with the view expressed that the subject to-day presents far wider scope than ever, particularly in regard to decorative lighting. The evolution of more suitable fittings, and improvements in lamp efficiencies, have been largely instrumental in increasing the possibilities. It now remains to bring home to the public the significance of the two-part tariff in this respect.

French Industrial Conditions

We have, on several occasions, reviewed the remarkable state of prosperity enjoyed in France while other countries have been experiencing a persistent crisis. For a time, it will be remembered, while several countries were in serious straits not only was there no employment in France, but, on the contrary, there were insufficient skilled workmen available to supply the demands of industry. To-day the unfavourable commercial conditions existing in the greater part of the world have extended their influence into France, mainly on account of a serious diminution in the number and value of foreign buyers; the markets connected with the heavy industries are depressed, with the consequence that business is difficult to transact and many industries are working at half-time. Nevertheless, France is relatively very prosperous to-day.

Recovery

To such an extent has France recovered and re-established her financial and economic position that even those people who reside in the country and are familiar with French conditions, both past and present, are amazed at the speed with which this recovery has been accomplished. It cannot be said that unemployment does not exist, but from what we hear from our correspondents, it is not much in evidence, and it is probable that the semi-official estimate that about 100,000 workpeople are idle is correct. The French people jealously conserve their home markets; further, large numbers of them are small owners of land to which they retire during periods of industrial quietness; in this respect the size of the country in relation to its population renders it easy for France to be self-supporting. The average Frenchman is extremely logical and he seems to realise that in returning to the land, even temporarily, he not only supports himself, but also stimulates activity in the heavy industries by creating demands for electrical plant and power, for various types of machinery, chemicals, and transport.

Supply in the Weald

A rich area which includes some of the most attractive residential districts in England

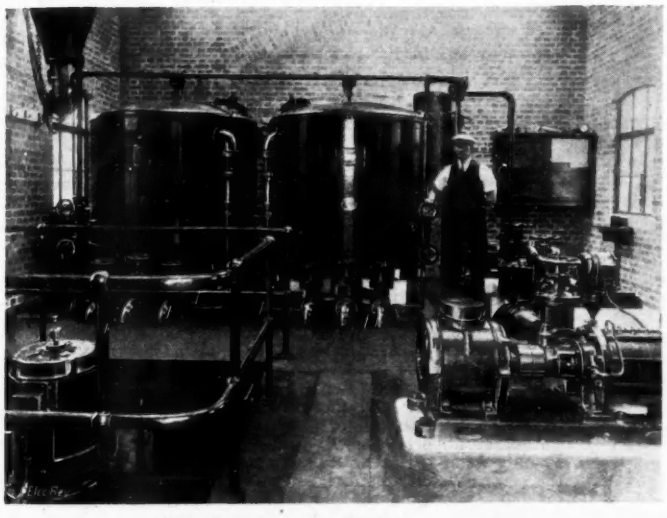
IN its brief career the Weald Electricity Supply Co., Ltd., has known no setbacks. Starting operations on November 5th, 1925, by distributing in Cranbrook, Tenterden, and Ticehurst a bulk supply received from Tunbridge Wells Corporation, the company escaped the handicap imposed on old-time undertakings of having to bear standing charges on a generating station during the first stages of development.

An important step was taken in 1927 when the electricity supply portion of the Crowborough Gas & Electricity Co.'s business was purchased and an unholy alliance brought to an end; the area of supply was increased from 210 sq. miles (1921 population 35,000) to 286 sq. miles (1921 population 54,000). Further territory was annexed in subsequent years, so that the area of supply is now 472 sq. miles in 10 rural and urban districts and 53 parishes of Kent and Sussex which have a population (1921 census) of close on 100,000, though it is known that the latter figure does not represent anything like the present number of inhabitants. The last Order obtained, in 1930, has enabled the company to afford a bulk supply to East Grinstead U.D.C.

A considerable portion of the company's territory still remains to be developed, but the work so far completed has necessitated the laying of 290 miles of mains and the erection of 118 sub-stations, at a capital expenditure of upwards of £370,000. Unlike other rural development schemes the mains are all laid underground. The reason for this is partly that the very rapid development of the countryside as residential property has made it difficult to forecast the ultimate route of an overhead line, and partly that transmission by cables to the extreme boundaries of the area at 6,600 V—the pressure cables have been supplied and laid by Callender's Cable and Construction Co., Ltd.

The sub-station kiosks forming disconnecting points on the transmission system are located at an average distance apart of 6,000 yards, and every natural feature has been taken advantage of to make them as inconspicuous as possible. A typical kiosk contains two ironclad Reyrolle 6.6-kV oil switches and a 25-, 50-, or 75-kVA English Electric transformer. A.S.E.A. graded-current and time-limit relays are used for protection. The tripping of a switch is signalled in two directions; prompt attention to any failure of supply is made particularly necessary in view of the several electric brooders connected to the mains. The most important distributing point is at Crowborough, where the largest sub-station is located, a simple but effectively designed building roofed with hand-made tiles. Here is also the district office with drawing office, test room, workshops, stores, and garage. Distribution in Crowborough was originally on the 240-V single-phase system with 2,400-V feeders. It is linked with the Weald 6.6-kV system by means of 75-kVA 6.6/2.4-kV English Electric transformers; the same company also supplied the two six-panel switchboards, one for 6.6 kV and the other for 2.4 kV. The 2.4 kV system, which is balanced between the phases, is being maintained for existing areas served, but extensions are being dealt with on the three-phase system for which one three-phase, 6.6 kV, 400-V transformer has been installed.

Major C. B. Grace, A.M.I.E.E., has been Engineer and Manager of the Weald Electricity Supply Co., Ltd., since its inception



Town Row Pumping Station

Building the Load

In the area covered by the company's Orders building activities, which have been so pronounced during the past few years, show every sign of continuing, while the company's policy of extending its mains in advance of actual requirements has proved of considerable encouragement to the property owners. In addition to the ordinary large and small private residences, the consumers include a large number of mansions that have been converted to schools, large hotels and country clubs, poor law institutions, public halls, cinemas, and places of worship. The smaller classes of consumers at Tunbridge Wells power station busbars—has thus been made practicable, whereas the reactance of overhead lines would have necessitated transformation to 11 kV. The system, which is laid out as a series of ring mains, has been so designed as not to preclude the adoption of other methods should the growth of load make this desirable.

The Transmission and Distribution Systems

The 6.6-kV cables, normally of 0.075 sq. in. copper, are unarmoured and are usually laid at a depth of 3 ft. in the grass margins of the roads, and protected by marking boards. In cases where private land has been crossed, no wayleave difficulties have been encountered due to opposition from the land-owners.

The 400/230-V cables are protected by one-strip armouring. They each contain five cores, phases and neutral being of 0.06 sq. in., and the fifth core (for public lighting control) of 0.145 sq. in. cross-sectional area. In some cases where long services are called for, trenching has been carried out by the consumers. All

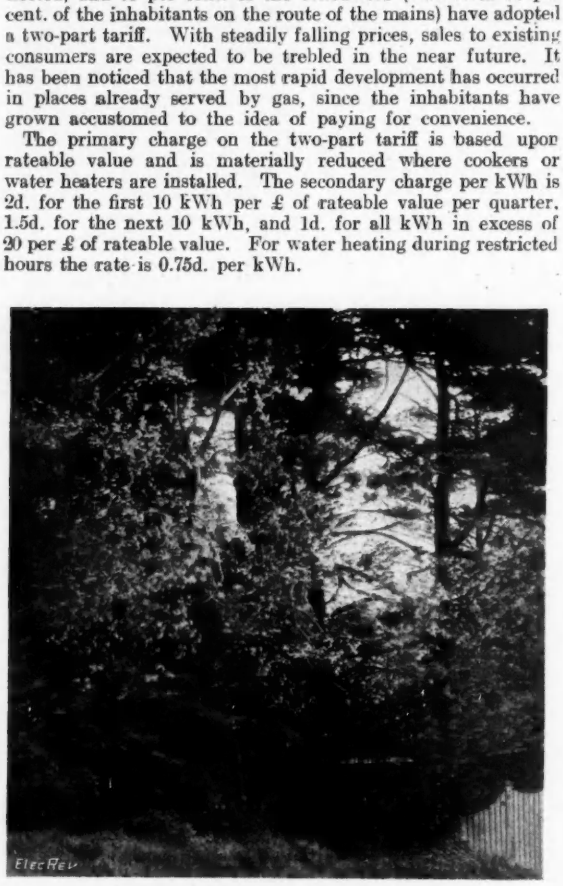
St. Dunstan's Church, Mayfield, floodlighted by 16 75-W lamps

have not been neglected and the occupants of several hundred cottages with rateable values not exceeding £15 are supplied with electricity at prices well within their reach, as is evidenced by the fact that in no case has such a consumer been disconnected.

The output of the undertaking is growing at a rapidly accelerating rate. Last year the kWh sold increased by nearly 100 per cent. to 2,050,000, yielding a gross revenue of about £34,000 at an average rate of 3.97d. per kWh; the maximum demand was 2,943 kW and the load factor 29 per cent. Similar progress is anticipated for the present year.

Though the average rate per kWh showed a drop of 25 per cent. from that of the previous year, it is still high compared with that of most urban undertakings. This is due to the large proportion of the output that is sold for lighting purposes, as is inevitable in any relatively new concern, especially in rural districts. The surface of the domestic load has so far only just been scratched, although over 300 cookers have been connected, and 75 per cent. of the consumers (who form 90 per cent. of the inhabitants on the route of the mains) have adopted a two-part tariff. With steadily falling prices, sales to existing consumers are expected to be trebled in the near future. It has been noticed that the most rapid development has occurred in places already served by gas, since the inhabitants have grown accustomed to the idea of paying for convenience.

The primary charge on the two-part tariff is based upon rateable value and is materially reduced where cookers or water heaters are installed. The secondary charge per kWh is 2d. for the first 10 kWh per £ of rateable value per quarter, 1.5d. for the next 10 kWh, and 1d. for all kWh in excess of 20 per £ of rateable value. For water heating during restricted hours the rate is 0.75d. per kWh.



A Typical Sub-station Site at Heathfield

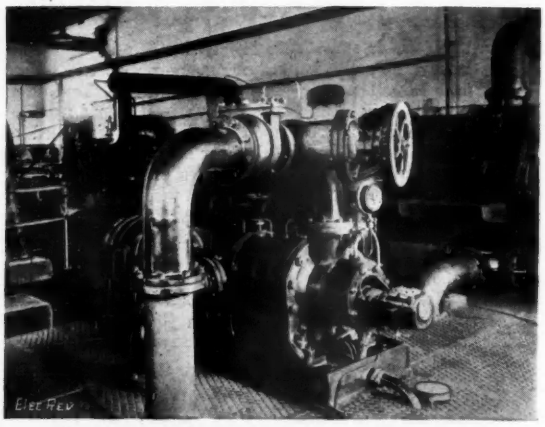
All types of electrical apparatus can be obtained upon hire-purchase terms with payments spread over three years. Premises can be wired under a hired-wiring scheme with payments spread over ten years.

All-electric Public Lighting

As mentioned in the Electrical Review of November 14th, 1930, p. 828, the company is responsible for the whole of the street lighting in several towns and villages. Contracts for ten years have been completed for 11 areas, in most cases in direct competition with gas. The total number of public lamps is 568 with individual capacities of from 60 to 200 watts. The type of fitting used is the "Esla" "Bi-multi." Many of the lamps are suspended across the middle of the street, and each lamp is controlled by a time switch.

Large Power Consumers

In addition to the bulk supply to East Grinstead there are other large consumers, the two most notable being the pumping stations of the Cranbrook District Water Co. and the Crowborough District Water Co. In the first of these a 53-b.h.p. bore-hole pump and a 100-b.h.p. main pump deal with 35,000 g.p.h. compared with the 14,000 g.p.h. of the old steam-driven pump seen in the background of the illustration, and the 24,000 g.p.h. of the almost as cumbrous gas engine installed in the same building. The Crowborough plant at Town Row, Rotherfield, pumps 5,000 g.p.h. and is also a neat, compact installation. The rate



Electricity displaces Steam and Gas at Cranbrook

charged is 0.81d. per kWh, subject to no demand being made between 3 p.m. and 10 p.m. during four winter months.

The whole of the company's operations are conducted from its head office at Hawkhurst. Owing to the scattered nature of the territory, certain electrical installation contractors (who must be on the "register") with depôts throughout the area have been appointed as official service contractors for their respective districts. A condition of this appointment is that a showroom for electrical apparatus and a day and night service for the benefit of the company's consumers shall be maintained at the depôt.

Our thanks are due to Major C. B. Grace, A.M.I.E.E., for his assistance in the preparation of this article.

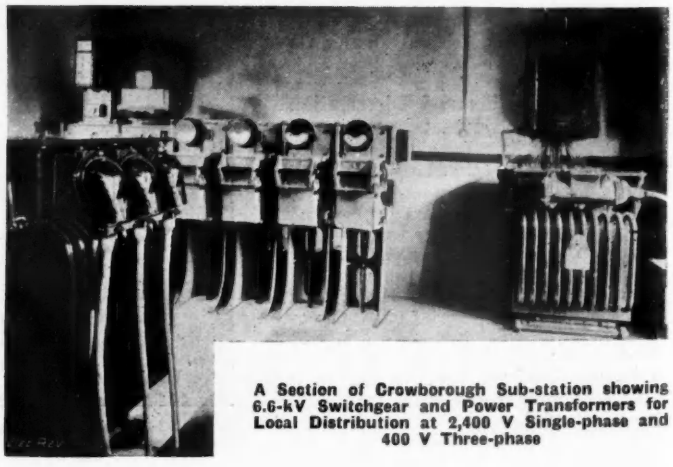
The British Patent System

It is now nearly three years since the British Science Guild published a report regarding the need for improvements in our patent system. This report formed the basis of the agenda of a Departmental Committee set up by the Government in May, 1929, under the chairmanship of Sir Chas. Sargant. This Committee issued its report in May last.

The findings of the Sargant Committee are analysed in a leading article in *Nature*, which states that they represent the minimum of reform that will be satisfactory.

Among the more important of the proposals were the extension of the scope of the official investigation as to the novelty of inventions; the extension of the judicial functions of the Comptroller of the Patent Office (to reduce the cost of patent litigation); a change in the tribunal of appeals from the Comptroller's decisions; and the strengthening of the law relating to unwarranted threats of patent litigation.

Another important new point related to Section 32A of the Patents Acts. Prior to 1919 the invalidity of a single one of the claims which define the scope of a patent was enough to invalidate the whole patent, but the Act of 1919, in remedying this hardship, made way for an abuse by removing the danger which a patentee had incurred if, in defining the scope of his monopoly, he had tried to cast his net unreasonably wide and to claim more than he had really invented. As a result, there has grown up a bad practice of using unconscionably wide verbal formulæ in patent claims, and the Sargant Committee proposes that this abuse should be checked.



A Section of Crowborough Sub-station showing 6.6-kV Switchgear and Power Transformers for Local Distribution at 2,400 V Single-phase and 400 V Three-phase

Neon-tube Signs. By E. A. Beavis, A.M.I.E.E.

Some of the results of oscillographic examination of current and voltage variations

FROM the time of its earliest appearance the neon lamp has found many useful applications, both scientific and commercial, but the more recent advent of the high-voltage tube has greatly increased the possibilities of its scope, particularly for sign and advertisement illumination. Neon gas is especially suitable for this type of lighting, it having rather an attractive orange-red colour; but other appropriate shades are possible by admixture with different gases and by the use of coloured-glass tubes.

These tubes are usually about 12 to 15 mm. in diameter, but vary in size up to 30 mm., the working current varying from 23 to 35 milliamperes, whilst the pressure employed is limited in this country to about 15,000 volts. Alternating current is used for operating the tubes and, as the voltage absorbed under running conditions approximates to 200 volts per foot of tube, the installation has to be divided up into a number of sections, each being supplied from an independent transformer of a few hundred volt-amperes capacity.

Gaseous conduction invariably has a static falling volt-ampere characteristic, indicating rapidly increasing ionisation once the arc has been struck; unless some means of limiting the current is adopted, the tube will be rapidly destroyed. This negative resistance effect creates instability, and the tube must therefore be run at constant current, the value of which is determined by external conditions. The usual low-voltage lamp contains a resistance unit incorporated with the bulb cap for this purpose; a detailed study and investigation of the characteristics of such lamps has been published elsewhere.*

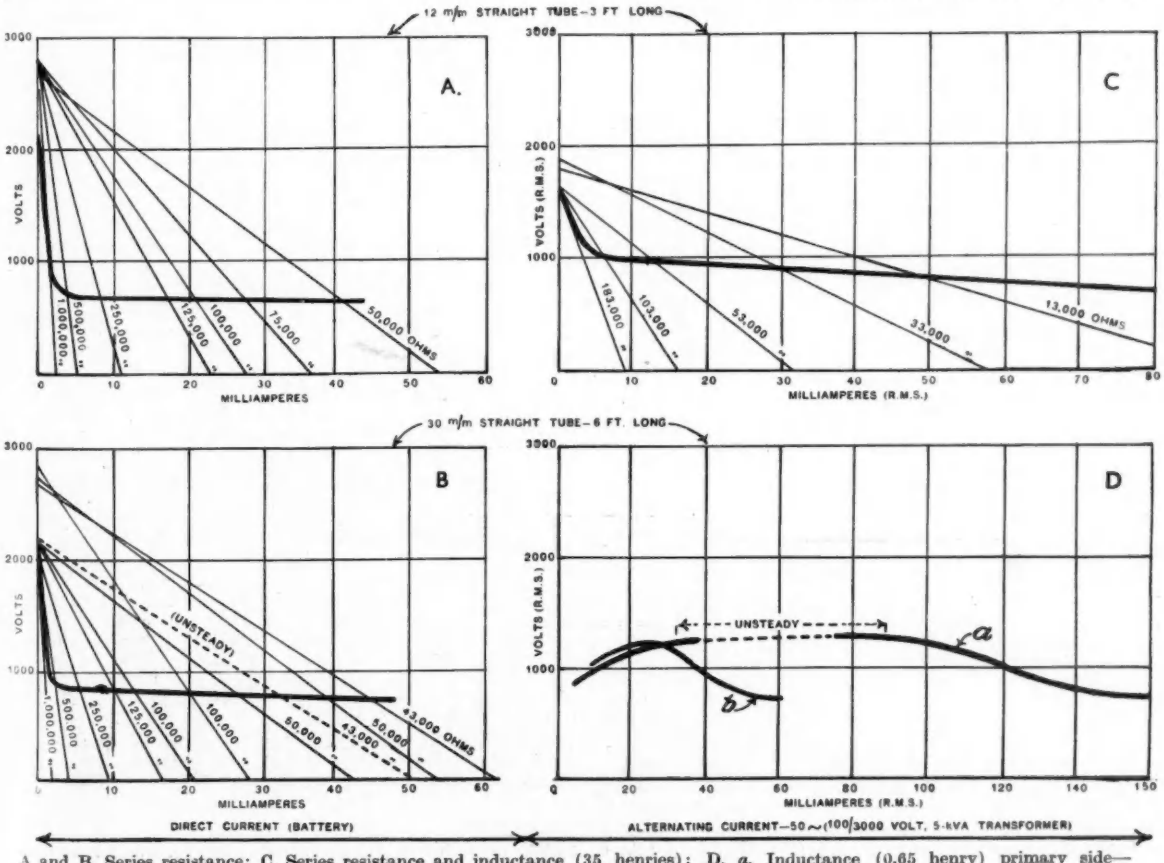
Results obtained from high-voltage tubes are somewhat similar, but variations occur over much wider ranges, due, no doubt, to the relatively greater effects of temperature and pressure with the larger volume of gas. The results of direct-current tests made with series resistance in circuit are volt-ampere characteristic curves A and B with two straight tubes of different types. The striking voltage does not appear to be always consistent, and appreciable variations occur on reversing the current. With alternating current and series resistance the light emitted by the tubes continually flickers on account of the abrupt making and breaking of the circuit as the tubes strike and become extinguished with the periods of the voltage wave. Reactance is necessary in the circuit to steady these fluctuations and smooth out the current wave; it may be present inherently in the transformer windings, or choke coils can be inserted in either the primary or secondary to produce the required stability.

In these circumstances the magnitude of the reactance will influence the apparent tube characteristics on account of the peculiar effect of the transients on the wave form (see curves C and D). With insufficient reactance the current is definitely intermittent, consisting of a series of peaky waves, as indicated by oscillogram (*a*), which represents the fluctuating current (20/25 mA) in a number of tubes fed from a small 350-VA transformer with no choke in circuit; the tubes are striking spasmodically and the current peak is rather high. Oscillogram (*b*) shows the voltage and current of a long tube connected to a 5-kVA 75-kV transformer, the primary voltage of which was adjusted to give the necessary secondary current required for normal illumination.

For commercial equipment special high-reactance transformers are supplied, rated at 150, 350, and 450 VA, at voltages of 5, 12, and 15 kV, respectively. They are totally enclosed in metal cases to which the mid point of the secondary winding is connected, the voltage to earth being thereby limited to half that of the tubes. A number of primary tappings is available for input voltage regulation, and a variable choke of suitable dimensions is connected in the primary circuit to enable the tube current to be stabilised at the required value for each section of the installation. The open-circuited secondary voltage is made as high as possible in order to ensure that the tubes will strike under the most adverse conditions likely to be met with in practice.

A number of tests has been carried out with equipment of this type, which was connected up experimentally as shown in the accompanying diagram. The variations of current and voltage under different conditions were examined by oscillograph, some of the results of which are given herewith. The number of tubes with which steady illumination can be ob-

* Pearson and Anson, *Proceedings* of the Physical Society of London, 1922, Vol. 34, pp. 175 and 204, and L. E. Ryall, *Journal of Scientific Instruments*, Vol. 7. June, 1930, No. 6, p. 177.



A and B, Series resistance; C, Series resistance and inductance (35 henries); D, *a*, Inductance (0.65 henry) primary side—*b*, Inductance (35 henries) secondary side.

D.c. and A.c. Pressure-Current Characteristics of Neon Tubes

tained is definitely limited, violent flickering resulting when too great a length is in circuit. An approximate drop in voltage of 50 per cent. on the primary side of the transformer appears to be about the usual working condition, and nearly 25 per cent. of it occurs in the choke. With the tubes giving apparently steady light oscillograms (*c*), (*d*), and (*e*) were

TABLE I.—Neon Tube Oscillations.

100-V supply—tube current 23 mA—steady illumination.

Conditions of circuit.	Periods of oscillation.
No lead-covered cable	1,590 per second.
7½ ft. l.c. cable	1,280 ,, ,,
26½ ft. l.c. cable	1,100 ,, ,,

obtained, and the current variation was arranged by manipulation of the choke. It will be noted that the voltage wave has a peaky form at the striking point in each half period and oscillation thereby commences, which is clearly indicated in the current wave. The effect of capacity is shown by oscillograms (*f*) and (*g*), the circuit working under practical conditions and the connection to the tubes being made with lead-covered rubber-insulated cable. The frequency of the superimposed oscillations was measured by means of a frequency bridge with the results shown in Table I.

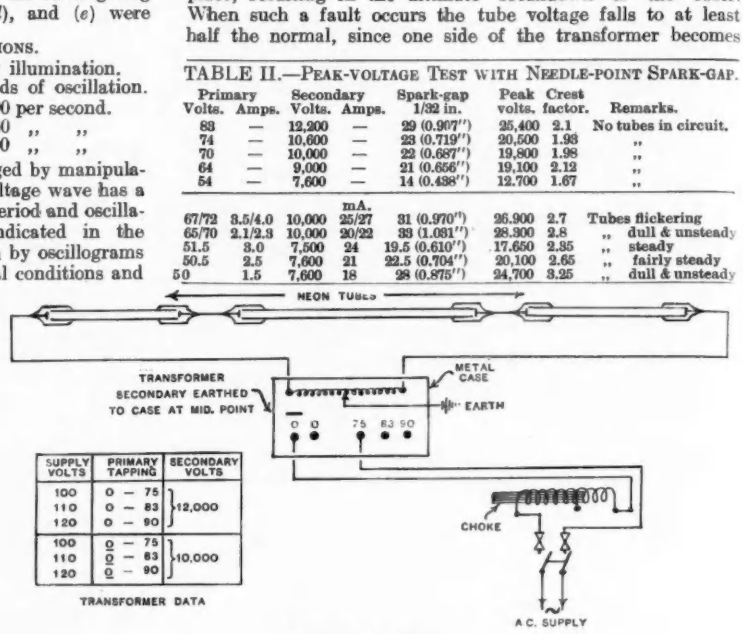
Increased capacity decreases the frequency, but increases the peak amplitude of the oscillation. In normal practice, on switching in the circuit the voltage rises to near its maximum value of 12,000 volts and falls when the tubes strike to about 6,600 volts as the working pressure (these figures were actually measured on a large sign recently erected), although the striking peak is, however, still present in the voltage wave. These conditions are represented approximately in oscillograms (*f*) and (*g*), and in order to ascertain the peak value of the voltage various measurements were carried out with a spark-gap and rectifying valves with the results indicated in Tables II and III.

The measurements were only very approximate, but they indicate that the crest factor is increased in the presence of the tubes, showing that the transformer peak voltage persists each half cycle for the purpose of striking the tubes.

It will be appreciated that the neon-tube circuit is far from being a simple one, and it is possible for high-frequency oscillations to be set up in practice, the effects depending upon the values of reactance and capacity existing in each separate installation. For the high-voltage connections small-conductor v.i.r. insulated cable is employed, the leads from transformer to tubes being lead cased usually for protective purposes. It is evident from what has been put forward that the cable insulation has to withstand continuously the full voltage to earth of the transformer, which is half the tube voltage and may therefore easily approach a peak value of 10,000 volts or more. Should discharges occur the ozone liberated during the ionisation of the air would quickly attack the rubber insulation and cause bad cracking to take place, resulting in the ultimate breakdown of the cable. When such a fault occurs the tube voltage falls to at least half the normal, since one side of the transformer becomes

TABLE II.—Peak-voltage Test with Needle-point Spark-gap.

Primary Volts.	Amps.	Secondary Volts.	Amps.	Spark-gap 1/32 in.	Peak volts.	Crest factor.	Remarks.
83	—	12,200	—	29 (0.907")	25,400	2.1	No tubes in circuit.
74	—	10,600	—	23 (0.719")	20,500	1.93	,,
70	—	10,000	—	22 (0.687")	19,800	1.98	,,
64	—	9,000	—	21 (0.656")	19,100	2.12	,,
54	—	7,600	—	14 (0.438")	12,700	1.67	,,
			mA.				
67/72	3.5/4.0	10,000	25/27	31 (0.970")	26,900	2.7	Tubes flickering
65/70	2.1/2.3	10,000	20/22	33 (1.031")	28,300	2.8	,, dull & unsteady
51.5	3.0	7,500	24	19.5 (0.610")	17,650	2.35	,, steady
50.5	2.5	7,600	21	22.5 (0.704")	20,100	2.65	,, fairly steady
50	1.5	7,600	18	28 (0.875")	24,700	3.25	,, dull & unsteady



SUPPLY VOLTS	PRIMARY TAPPING	SECONDARY VOLTS
100	0 — 75	12,000
110	0 — 83	
120	0 — 90	
100	0 — 75	10,000
110	0 — 83	
120	0 — 90	

TRANSFORMER DATA

A Neon-tube Circuit

TABLE III.—Measurement of Rectified Secondary Voltage.

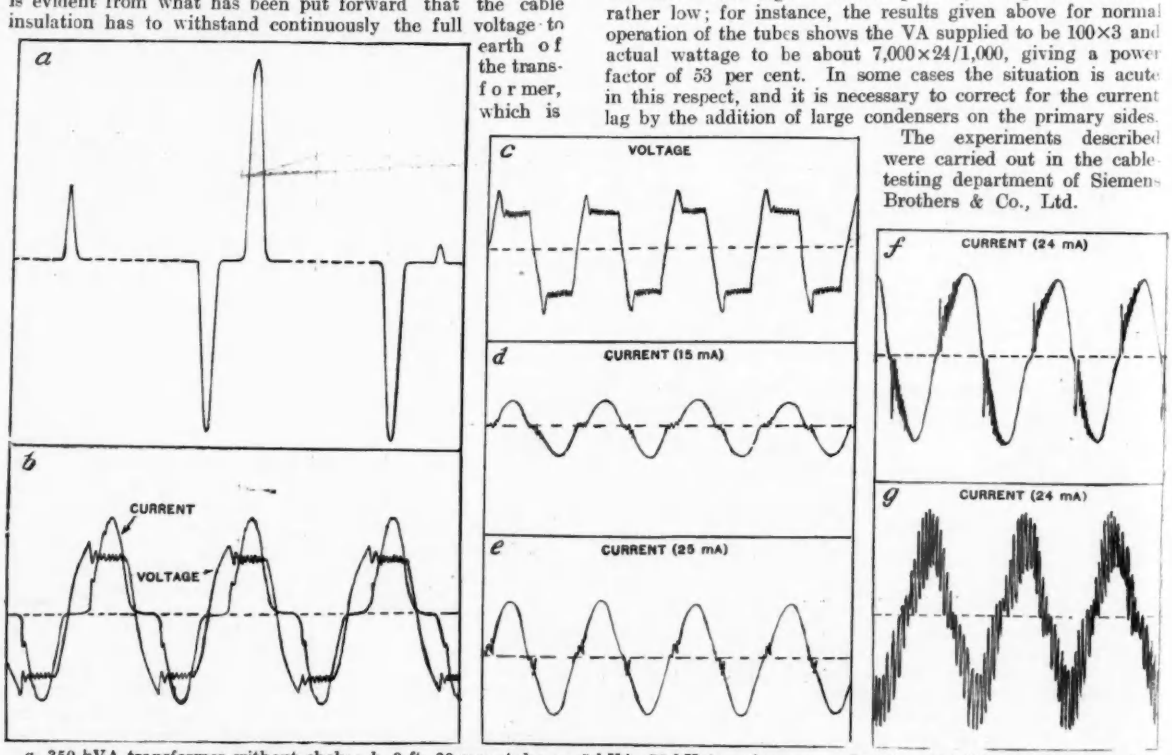
Open-circuit test: Secondary volts.	Rectified volts.	Crest factor (approx.)	Tubes in circuit: Secondary volts.	Rectified volts.	Crest factor (approx.)	Remarks.
4,800	7,000	1.46	7,600	19,500	2.57	No cable in circuit.
6,600	10,500	1.59	—	—	—	—
9,000	15,500	1.72	7,200	18,500	2.57	7½ ft. l.c. cable
10,800	20,700	2.07	—	—	—	—
11,900	23,000	2.10	6,900	19,250	2.79	26½ ft. l.c. cable

Primary current 3 amperes, secondary current 24 mA.

earthed, but the fault current is limited and probably does not exceed about 50 mA.

The actual power consumed is relatively small and, on account of the high reactance present, the power factor is rather low; for instance, the results given above for normal operation of the tubes shows the VA supplied to be 100×3 and actual wattage to be about 7,000×24/1,000, giving a power factor of 53 per cent. In some cases the situation is acute in this respect, and it is necessary to correct for the current lag by the addition of large condensers on the primary sides.

The experiments described were carried out in the cable testing department of Siemens Brothers & Co., Ltd.



a, 350-kVA transformer without choke; *b*, 9-ft. 20-mm. tube on 5-kVA, 75-kV transformer; *c*, *d* and *e*, 350-VA transformer and choke; *f*, no l.c. cable in circuit; *g*, with l.c. cable connections 26 ft.)

Oscillograms showing Variations of Current and Voltage under Different Conditions

The Refining of Silver By C. Campbell

The electrolytic method is the most satisfactory, the cost being exceedingly small

THE electro-refining of silver has been accepted within the past few years as the most satisfactory means of both purifying the metal and also recovering all rich by-products. Before the electrolytic systems became so popular it was quite customary to find silver on the market which contained 0.1 per cent. of gold and also traces of platinum. Apart from the values of the materials thus lost, it seemed as though no ordinary process could be economically successful in attempting to recover such small amounts of precious metal.

The " Moebius " was one of the first systems to make such a process possible. It was improved on by the " Balbach Thum " process which of later years has itself been somewhat modified. The object is to obtain pure silver and also separate all precious metals for their subsequent recovery.

The electrical connections of plant using a modified " Balbach Thum " process do not differ widely from those employed in other electro-metallurgical plant, but any failure to react and ensure a sound deposit when dealing with an expensive material like silver would, of course, be serious. To suit the convenience of adjacent equipments engaged on other deposition work the practice accepted as most suitable consists of having two sets of tanks in parallel.

The system in this country differs only slightly from that employed in America, and the current density is maintained at 50 amperes per square foot. The cells are very simply constructed, and consist of shallow glazed porcelain troughs, the bottoms of which are horizontal. The surface of the bottom is lined with Acheson graphite, fitted in square slabs and connected by means of a special mortar. Tests are made to ascertain that the mortar when set will not act as a source of loss to either electrolyte or current. The graphite bottom forms the cathode and presents a large surface of material which in no way interferes with the purity of the deposit. It should be noted that the deposit is permitted to form on top of the cathode for the period of one shift (8 hours) prior to removal, since the current passes through it practically unaltered. The graphite is supplied in slabs of one foot square, and the area of the cathodes is about eight feet square.

Anodes

The anodes consist of plates of crude silver obtained from various smelting operations, which have been refined to free them from such base metals as lead, tin, antimony, iron, copper, &c. Since the last metal to be removed by the smelting is copper, there is always the risk that a slight percentage of it may inadvertently be left in the silver. It, however, seldom reaches the extent of 0.1 per cent. copper, and in some respects acts as a slight advantage in electrolysis.

Whilst the molten silver is reaching its final stages a sample is taken and the gold and platinum contents ascertained. Should none be present, the silver is simply cast in bars for the market. A presence of only 0.03 per cent. of gold, however, makes it a paying proposal to conduct electrolysis, so that the metal is almost invariably cast as anodes, which are arranged horizontally on wooden brackets, or shelves, provided with glass rods on which the anodes themselves rest above the cathode. The shelves are enclosed in canvas diaphragms wherein the anode slimes deposit collects during electrolysis.

To permit of all the silver being completely dissolved, pieces of anodes from previous electrolysis are fitted between the fresh ones. Since anodes which are poor in gold content dissolve readily in the acid and those rich in gold offer greater resistance, it is customary to place the rich plates on the bottom and one poor one on top, *i.e.*, further away from the more intensive electrolytic action. Another chemical point is that it is advisable when palladium is present in some anodes to divide them throughout the baths so far as possible.

The anode plates are held in position by a copper contact plate, clamp, and screw, which permit of their simple adjustment. The current is led in from the bus-bars by cable to the same plate, and the negative connection is made to the graphite cathode. After placing in position, the shelves are dipped into the electrolyte and the current switched on.

Voltage

The pressure varies from 3 to 4 volts, the reasons for this high value being largely the resistance of the slimes which settle on the diaphragm and the distance it is necessary to have between anode and cathode. This is, is a sense, a disadvantage which might be attributed to most plant in which the horizontal system of electrolysis is performed.

With the " Moebius " and similar processes wherein the anodes and cathodes are arranged horizontally the voltage never reaches a high figure, due to the fact that the electrodes are not far apart and any slimes which form fall below where they accumulate and thus leave the plates clean for the furtherance of electrolytic action. But close connection of the electrodes also has the disadvantage of heating the electrolyte, as a result of which it is necessary to keep the latter continually circulating and passing through a cooling arrangement.

It will thus be observed that the modified " Balbach Thum " process has to sustain on occasions a fairly high voltage loss, whilst the electrolyte is maintained in a comparatively cool condition. The " Moebius " system avoids this loss, but a larger plant is necessary to cope with the heated electrolyte.

Electrolyte

One of the features of the electrolysis of silver generally is that the costs are exceedingly low. The electrolyte consists of a 0.5 per cent. solution of nitric acid, whilst the silver content is maintained at 3 per cent. Should the latter figure be allowed to fall, impurities would be deposited on the cathode. To ensure that no such conditions can prevail, the addition of a small proportion of silver nitrate is made daily.

As the copper content is continually rising, due to fresh plates being electrolysed containing a small percentage of that metal, it is necessary to remove a small proportion of the electrolyte in order to reduce the copper content; that is, some of the impure electrolyte is removed and replaced by fresh silver nitrate. The maximum copper content permissible is 4 per cent., after which it is necessary to renew the whole of the electrolyte in each of the troughs.

It should be noted that if no copper is present the silver deposited will have a fluffy flocculent appearance, unlike the sharper more crystalline deposit when copper is present. Hence it is always necessary to have a small proportion of copper present to make a deposit of good appearance and yet not overstep the 4 per cent. copper limit whereby impurities would be directly precipitated. To secure the best conditions, the electrolyte should show on analysis: nitric acid 0.5 per cent., silver 3 per cent., and copper 1 to 3 per cent.

Whilst electrolysis is proceeding the anodes are noticeably dissolving away, leaving a dark brown, or black, deposit of impure gold, &c. Meanwhile silver is deposited on the carbon cathodes in the form of a fine white crystalline shining deposit, which is removed daily by means of wooden rakes provided with leather or rubber ends, so that no carbon is scraped off the cathode slabs. To get at the deposit the current is disconnected from four of the troughs (usually by an arrangement of the bus-bar connections, when other plant is also in operation, so that the motor need not be touched).

The shelves containing the remains of the anodes and slimes deposit are raised bodily by means of a pulley block and the silver deposit removed from the electrolyte below. The latter liquor is usually green in colour and smells of nitric-oxide fumes, due to the decomposition of the acid by the electrolysis. After washing the silver deposit with dilute nitric acid and water on a cloth, it is spread over an oven wherein it is dried prior to going to market.

Silver obtained by electrolysis is the purest form and contains 99.9 per cent. of silver; 99.8 per cent. is considered a poor figure. The remainder is made up of moisture 0.02 per cent., carbon 0.03 per cent., and gold 0.001 to 0.005 per cent.

Anode Slimes

Although the silver deposit is removed daily, the silver anodes are, as a rule, only partly corroded, and it usually takes about three days for the latter all to dissolve. When that time has elapsed the shelves are emptied of their anode deposit by removing the remains of plates and scraping and washing the cloth. The deposit is chiefly gold from which the silver has been almost entirely removed. It contains approximately: gold 90 to 94 per cent., platinum 4 per cent., and palladium 0.4 per cent.

From this point the deposit goes to a further electrolytic, or an alternative wet chemical, process to separate the foregoing metals. The process is worked continuously and, having two sets of four troughs in parallel, it is simple to disconnect one set and keep the other set going.

The manner in which the plates and cathode slabs lie causes a faint, but continual, circular motion, which assists in reducing polarisation actions to the minimum. The small amount of liquor removed daily is collected and the silver precipitated chemically either by metallic copper or by a solution of common salt.

Since nitric-oxide fumes are evolved throughout electrolysis, the atmosphere would soon become very foul, and it is necessary to have fans distributed throughout the building to maintain a constant flow of fresh air. This, however, does not prevent the copper bus-bars from suffering slightly, which is apparent by the evidence of green spots due to corrosion. In large electrolytic plant it is the customary practice to house the motor plant separately.

Domestic Water Heaters

British apparatus of the self-contained type now compares favourably at all points with any of Continental design

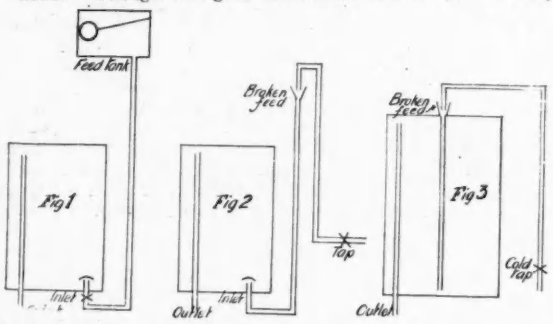
By A CONSUMERS' ENGINEER

THE usual "self-contained" vessel consists of a lagged water container, carrying its own heating element and thermostat as integral parts, and assembled for fixing into the hot-water system. They can be arranged to give hot water at any number of points. They can be fixed directly over a bath, basin, or sink, and may be connected to the existing hot-water service, with a tap on the inlet side, the outlet spout being left open. If no hot service pipe is available, they can be connected to the cold-water main, but the water authorities often require a ball-valve feed tank or a "broken feed." Fig. 1 shows the first arrangement. There are several ways of providing a break, and two of them are shown in figs. 2 and 3. Non-return valves are permitted in some areas, but they are best avoided, as they need inspection from time to time, and even then there is no certainty that they will always function.

"Push-through" Heaters

When fixed in this way (generally known as "push-through" method), the heaters have a tendency to drip at the outlet, due to the expansion of the water while heating up. This is objectionable because of the stain which is made on the bath or basin, particularly where the water is rich in iron. When connected, as shown in fig. 1, dripping is the only objection apart from the cost of the feed tank, but there is a number of makes in which feed tanks are incorporated. They are neater and generally cheaper than separate tanks, but before using them the water authority should be consulted, as some of them will not accept such an arrangement.

When connected, as in figs. 2 and 3, there is practically no "head." Though in fig. 2 the funnel can be fixed at any



desired height, it is not wise to go very high, as the water standing in the pipe has to be drawn off to the level of the water in the container, involving waste of hot water. Despite the absence of "head," the flow is quite sufficient for wash-basin purposes. Unless the feed is properly regulated, there is a risk of splashing and of "flooding" at the break or funnel, and there is always the hygienic objection that the break permits of the entry of dust to the vessel. There are, however, types available which overcome both these difficulties.

Water authorities might well permit heaters of this class up to, say, five gallons capacity, to be connected direct to the cold-water main, without any ball valve or broken feed intervening. This would materially reduce installation costs, and thus help to popularise water heaters. The water authorities should realise that the greater the use of independently heated appliances, the less is the wastage of water, as the user realises that he is paying something for his hot water.

In old houses where the scullery sink is at some distance from the ordinary hot-water storage cylinder, the installation of this type of heater over the sink has much to recommend it, as the waste and delay occasioned by running off the tepid water lying in the pipe is avoided.

The larger-sized heaters can be fixed to work in conjunction with, or to displace, the ordinary storage cylinder. While houses are in course of construction it is sometimes possible to get the builder or architect to instal one. When so fixed, they can be either coal-fired from the kitchen or other grate, or electrically heated, according to household circumstances from day to day. In many houses they would be heated from the fire during the daytime and electrically at night—quite a good plan from the supplier's point of view.

It has been necessary in most houses (owing to lack of floor space) to fix the heaters on walls, which are frequently constructed of lath and plaster. Wall-type heaters can now be obtained with cradles or similar supports which allow some part of the weight to be taken by the floor if room can be found to get a bearing.

Until recently Continental heaters have been popular partly because of price, partly because of better finish, but chiefly because of the more reliable types of thermostat fitted. British makers have, however, in the last two years put their backs into the job, and now produce heaters which compare favourably on all points with foreign examples.

The heating element itself in this class of heater is naturally an immerser. Generally, it is fixed vertically in wall-mounting types and horizontally in floor types. When fixed in a bath-room or any upstair room in a modern house, where the feed tank is generally near the ceiling of the same room or, at any rate, of a room on the same floor, it is sometimes impossible to get the cylinder high enough from the floor to permit of the withdrawal of the element or the thermostat should occasion arise. In older houses where the feed tank is in the roof, or in those areas where it is still permissible to fix them there, this point does not arise, neither does it when the cylinder is being fixed in a ground-floor room with the feed tank in a room on the floor above.

Construction of Water Containers

In hard-water districts galvanised iron can generally be used for the water container with safety, but in the soft-water districts tinned copper is preferable, and in some cases essential. It is generally found that tinned copper makes a stronger appeal to the consumer, and as the cost is not a great deal higher, the weight somewhat less, and the life probably longer, a case can be made out for using copper in all cases, except where the water pressure is unusually high, when it is preferable to use iron cylinders on account of their greater strength. The cost of a copper cylinder rises very rapidly with increase of the pressure which it has to withstand, but this can often be overcome by the fixing of a feed tank at a lower level than the one from which the normal supplies in such a building are taken.

The lagging of these heaters has so far been exceptionally good. I am of the opinion that the costs of British heaters were high partly because endeavours were made to reach a higher standard in this respect than that aimed at by foreign makers, good as their efficiencies were. It should be kept in mind that the energy to be used is being supplied at a low rate in almost every case, so that the necessity of reducing loss is not a clamant matter, and there is a limit beyond which efficiency of operation is not worth the extra capital cost entailed. Further, the loss from the heater itself is only a part of the total loss from the hot-water system as a whole, and often only a small part.

The E.D.A. Report

The most usual ways of fixing these heaters are outlined in the E.D.A. Report No. 867, which constitutes a useful handbook for practical purposes. It is slightly ambiguous in one or two places, due probably to the vagueness of the various regulations regarding the fixing of water heaters of all classes issued by water authorities, which the E.D.A. most likely had in mind when framing the report. Such regulations are very far reaching, and no doubt are as necessary in a general way as are some of the regulations which are drawn up by electricity supply authorities.

The question does arise, however, as to whether or no it is necessary to adhere to some of them so far as electric water heaters are concerned. Weight is given to this question by the wording of a paragraph in the Model Byelaws for the Prevention of the Waste of Water issued by the Ministry of Health (No. 21). In these byelaws, with which presumably the regulations issued by the British Water Boards Association and other water authorities have to comply, the following appears (on page 22) as part of Requirement No. 28, which deals with the necessity for fixing feed tanks, &c.:—"Provided that this requirement shall not apply to any electrically-heated apparatus, properly designed and controlled as regards both water and electricity."

This proviso implies that electric water heaters are in some measure immune from faults which have to be guarded against in other types, but it leaves it open for any water authority to put its own interpretation on the words "properly designed and controlled."

It is suggested that the E.D.A. Water Heating Committee would be rendering a useful service to the industry at the present time if it could get the British Water Boards Association to give an interpretation.

Cable-manufacturing Developments

The new straight-through lead-sheath press operates so that the lead stream does not part and re-unite in the container

ABSENCE of any longitudinal weld in the lead sheathing; automatic cleaning of the container; no tendency towards corrugation of the lead; lower oxidation of the lead due to pouring it into a closed container; lower extruding pressure (12 tons per sq. in. maximum for pure lead and 15 tons maximum for alloys); easy changeability of the points and dies; central heating near the admission of the lead charge and consequent ease of temperature control: these are the advantages put forward for the new straight-through cable lead-sheathing press invented by Mr. E. E Judge, assistant works manager at the Gravesend works of W. T. Henley's Telegraph Works Co., Ltd., and developed by the company. The importance of the claim that no longitudinal weld is produced in the sheathing, thus abolishing all liability to longitudinal splits, has resulted in much interest being created in the electrical world, both at home and abroad. Patents have been secured by Henley's for Great Britain, France, the Irish Free State, the United States of America, Belgium and Japan, and Krupp's have secured the Continental manufacturing rights.

Fig. 1.—Tongues of New Charge in Latter Stage of Extrusion

In order that the importance of the development should be appreciated, it is advisable to outline the procedure in the ordinary cable lead press and also to make some comparisons.

Lead when molten, or if heated in the solid state, rapidly becomes coated with a film of oxide, and when introduced into the container of a press a new charge of molten lead, although it rapidly solidifies and cools down to the temperature required for extrusion, remains hot for a sufficient length of time for the lead to become surrounded with a more or less complete envelope of oxide. It will be seen then that the new charge and the residue of the preceding one in the container of the press are partially separated by an oxide film. Further, under adverse conditions, an oxide layer of considerable thickness may remain at the top of a charge, promoting further separation of the sound metal in succeeding charges. On application of pressure for extrusion, the new charge, being hottest in the centre, commences to push forward as a tongue of metal surrounded more or less by its oxide film, the tongue passing into and finally through the residue of the charge of lead that preceded it.

In any ordinary type of lead press for cables the stream of solid lead during extrusion is parted to enable it to pass around the cable on its way from the container to the die of the press, the stream re-uniting on the opposite side of the cable. Further, in most vertical presses there is a bridge piece at the top of the die box placed parallel to and over the cable, introducing a division and re-union of the lead stream. The tongue of metal enveloped by oxide coating is thus forced forward divided into two tongues which meet again usually at the top and bottom of the cable, whence they pass forward parallel to the cable, a tongue of metal thus being on either side of the lead sheath. Eventually the new charge occupies the greater part of the sheath as it emerges from the die, the sheath consisting essentially of two semi-circular shaped halves more or less completely surrounded by an oxide envelope and joined at the top and bottom. The presence of the oxide envelope renders the welds at the junctions potential sources of weakness. If the oxide is merely a film the weld will be sound, but an appreciable thickness of oxide separating one charge from another in the container of the press will eventually show up as weakness of the longitudinal weld. Figs. 1, 2 and 3 are sections of lead sheath etched to show up the crystal structures, fig. 1 depicting the tongues of metal comprising the new charge in the latter stage of its extrusion, fig. 2 showing the semi-circular tongues of the new charge on each side of the weld remaining from the previous charge, while fig. 3 illustrates the weld towards the conclusion of the extrusion of a charge. Residual oxide from the extrusion of previous charges tends to accumulate at the weld and may be seen at the mid-point between prominent oxide inclusions, fig. 1. The origin of the flow markings which can be detected by etching sections of the lead tube is illustrated diagramatically in fig. 5.

The essential difference between production of the sheath so far described and that produced by the Henley patent straight-through press is that the stream of lead does not part and re-unite in the container of the latter. Replenishment of the lead is made by pouring molten metal into the container which actually surrounds the cable, the molten lead forming a complete ring around the cable and solidifying in this position. On extrusion, this solid ring of metal is merely forced forward

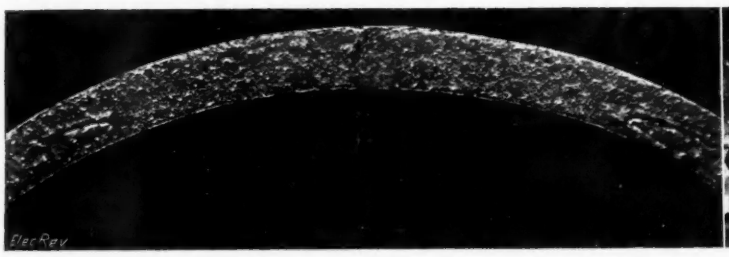


Fig. 2.—Tongues of New Charge each side of Weld from previous Charge

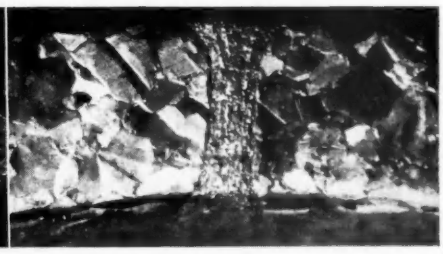


Fig. 3.—Weld near Conclusion of Extrusion

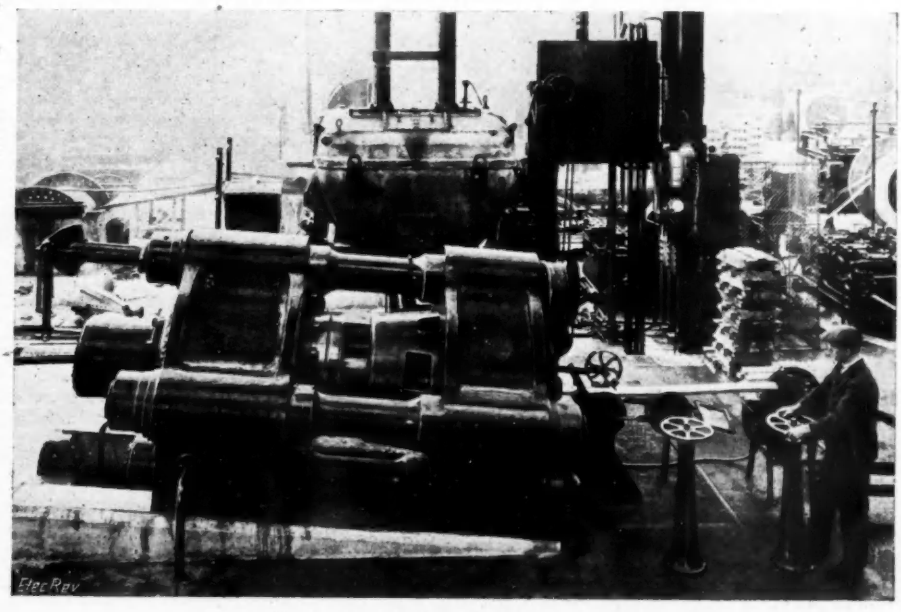


Fig. 4.—Henley Straight-through Cable Lead-sheath Press

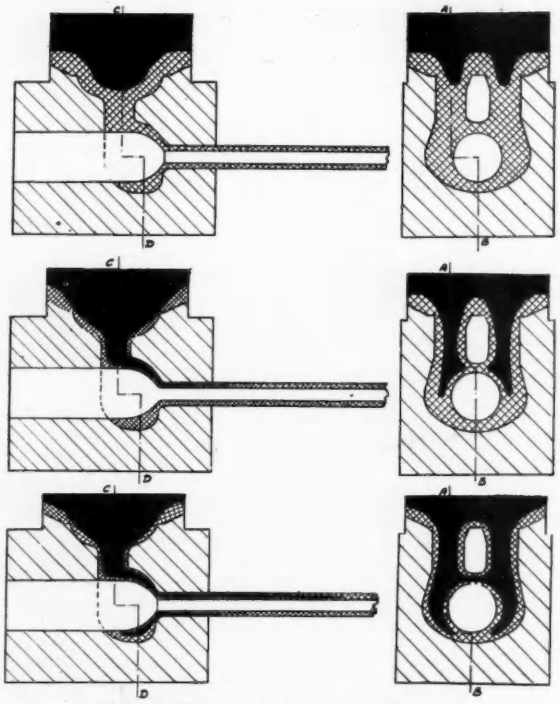
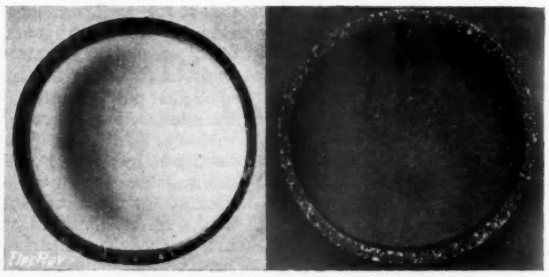


Fig. 5.—Flow of Lead in Ordinary Press

through the die of the press, and as there is no division or junction of streams of solid lead due to the passage of the lead around the cable, a continuous longitudinal weld cannot be formed. The new charge, although necessarily enveloped by a film of oxide, is forced forward as an annular shaped tongue into and through the residue of the previous charge. It is thus joined to the latter by an annular shaped sleeve junction which is so elongated as to occupy a length of about 20 yards in a tube of about 2½ in. diameter. Figs. 6 and 7 show etched sections of sheath from a straight-through press, the former being a section taken where the new charge has not completely occupied the total area of cross section of the sheath, parts

Fig. 8 illustrates the development of the long annular scarf joint between charges produced on the straight-through press, and consideration of the nature of the junction will make it obvious that the structure shown in the photographs cannot produce a longitudinal weld similar to that produced by the usual types of press. Further, the straight-through press provides filling arrangements such that most of the oxide which inevitably rises to the surface of lead on replenishing the container is excluded from that portion of the charge which is extruded.



Figs. 6 and 7.—Etched Sections of Sheath from Straight-through Press

The following table gives the principal data concerning the operation of the new press:—

TABLE.

Lead capacity	1,000 lb.
Maximum internal tube diameter	4 in.
Lead pressure (max.)	15 tons per sq. in.
Water pressure (max.)	3 tons per sq. in.
End load	2,800 tons
Effective stroke	13½ in.
Output	
Working stroke	3½ to 4½ min.
Average rate of discharge	6.7 tons per hour
Return stroke	1½ min.
Cleaning ram and moving to filling position	1½ „
Pouring	1 „
Closing, filling hole and applying initial pressure	½ „
Waiting	5 „
Total time per charge	13 to 14 min.
Average rate of output over operating cycle=4,444 lb.,	say 2 tons per hour.

The actual output over a period depends on many factors, *e.g.*, length of runs, size of drums, size of cable, temperature

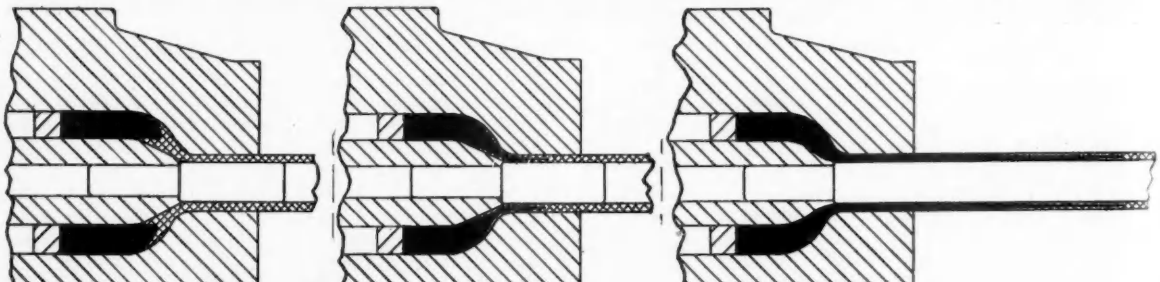


Fig. 8.—Flow of Lead in Straight-through Press

of adjacent charges, each forming complete rings, being clearly visible, and the latter a section taken when the charge completely occupies the sheath and no internal irregularity whatever is present.

of shops, facilities available for changing drums at back and front of press, and the efficiency of the operators. The time required actually to change a point and die is 20 minutes, but this does not include the time required to size up the lead.

Additional Items of Interest Seen at the Gravesend Works

During our visit to Henley's Gravesend works to see the new lead press our attention was attracted by a number of developments which have resulted from the progress made since we last described the factory in our issue of December 24th, 1926, p. 1023.

A considerable area of the old Rosherville Gardens (about 190,000 sq. ft.) on the other side of the Crete Hall Road bordering the major portion of the factory has been taken over and used for works extensions which include, *inter alia*, a braiding shop, a large woodworking shop chiefly devoted to the making of cable drums, a compound-making installation, a large warehouse and a very extensive suite of works offices. A feature of the woodworking equipment is a machine which prepares laggings to be secured to drums without nails. In one operation it cuts half-tenons at the ends of the laggings for fitting in the drum flanges and also cuts shallow grooves on the outside for accommodating steel bands which are secured at the ends by "Signode" seals.

It was interesting to learn that the steam obtained from waste wood, &c., consumed in a small Babcock & Wilcox boiler equipment has made the installation worth while.

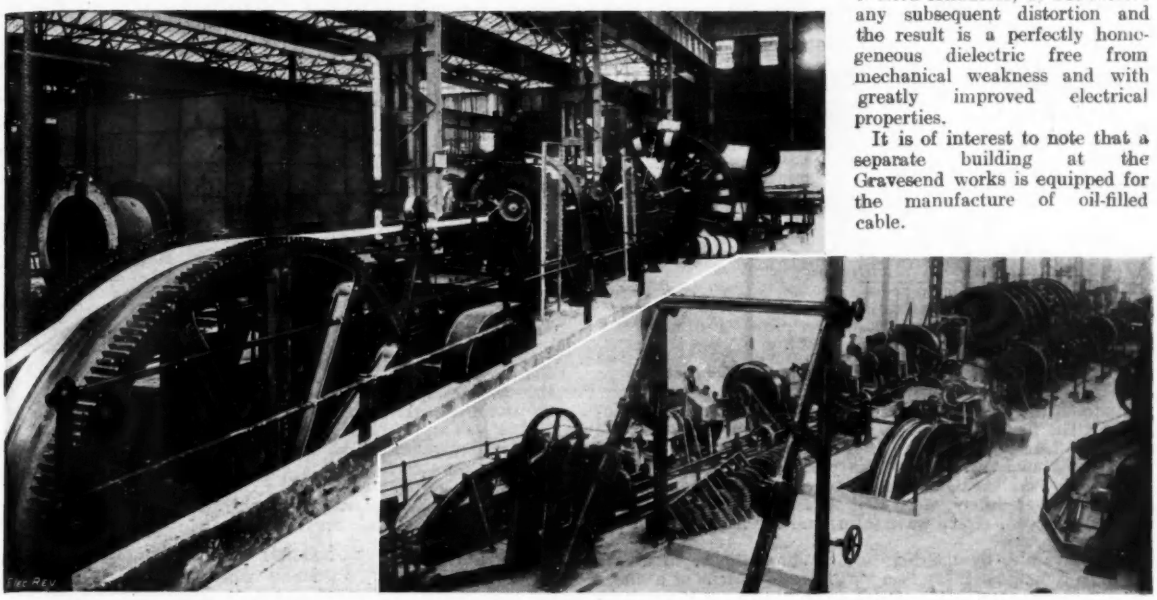
The compound-making equipment consists of a row of ten jacketed containers, five for joint-box compound and five larger ones for cable-serving compounds, served by circulating hot oil from an oil-fired furnace. The runway crane over the yard of the older portion of the works has been extended so that it is common to the yard at the extension as well, most of the despatching being dealt with at the newer section.

Quite a lot of new and unusual machines, &c., are also to be seen in the older part of the works. For instance, in the

wire-drawing room there is an electrically-heated annealing furnace. The chamber stands over a water tank below floor level in which operate two containing tables for the coils of wire. Normally one is submerged and the other is above the water in the oven under treatment. The movement of the tables is hydraulically controlled. The chamber is water sealed and loaded at 350 kW, and the actual annealing is effected in dry superheated steam. It is fascinating to watch the shaping of cores on stranding machines. The core passes through specially shaped rollers which revolve about the core once, so as to give the complete " twist " of the conductors in the required length. The fruits of this work are to be witnessed when the cores are passed to the laying-up machine on which they automatically " fall " into position, no crushing or wrenching operations being required.

In the normal method of manufacturing three-core shaped-conductor cable the core is twisted after the papers are applied, an operation which naturally introduces wrinkles and spaces into the mass of paper dielectric. With this new method adopted by Henley's the papers, being applied to an already twisted conductor, do not receive any subsequent distortion and the result is a perfectly homogeneous dielectric free from mechanical weakness and with greatly improved electrical properties.

It is of interest to note that a separate building at the Gravesend works is equipped for the manufacture of oil-filled cable.



Large Laying-up (7 ft. 6 in. bobbins) and Wire-armouring (96 bobbins) Machines seen at Henley's Gravesend Works

Summer Meeting of I.E.E. Students and Graduates

THE summer meeting was held this year from July 18th to July 28th in Northern Italy and South Switzerland, 61 members taking part. Leaving Victoria on the morning of the 18th, after a boisterous Channel crossing and an uneventful railway journey, Milan was reached middle day on the 19th. This interesting city was the headquarters of the party for the first part of the trip, before moving back to Glions for the second half. Whilst in Milan visits were made to the Milan Engineering College, the Telephone Exchange, to the works of the Pirelli Co. and of Brown Boveri, as well as to places of interest in the city itself. At the works of the Pirelli Co. the party saw the manufacture of all types of power cable, ranging from low voltage distribution to the latest 132-kV oil-filled cables. There was also some activity in the making of different types of quadded telephone cable. A tour of the research department, where demonstrations of materials testing were given, proved specially interesting. At the Brown Boveri works, the party saw heavy electrical machinery in course of erection; of particular note were some double- and triple-frequency generators and convertors.

During the stay in Milan the party made a mountain trip to visit the hydro-electric plant of the Societa Elettrica Cisalpino. The party left Milan in charabancs for Chiavenna, passing along the east side of the Lake of Como. Staying the night at Chiavenna, a picturesque Italian town 4,000 feet up in the heart of the mountains, the party proceeded next day, *via* the control station at Prestone and up the Spluga Pass, to visit the dams of Stuetta and Cardanello. On the return journey the members stopped at the central generating station at Mesa and inspected the plant there. During this trip much admiration was expressed at the ingenuity, and the care in detail, which had been shown in the design and construction of the plant and the transmission line towers which run through this mountainous district.

The party left Milan on the 23rd for Glion, the headquarters for the remainder of the tour. This village is situated 800 feet above the Lake of Geneva, with a fine view over the lake to the Savoy Alps, and the Dent du Midi. The magnificence of the view was slightly offset by the inaccessibility of the place. Two courses were open: an expensive funicular railway or half an hours mountaineering. Practice in the latter method has probably produced several potential mountain-climbing enthusiasts in the party. Expeditions from Glion were made to see hydro-electric plant in the mountains used in connection with railway and domestic requirements. The chief trip was to the Barbarine Dam, which supplies water to the Swiss Federal Railways station at Chateaux D'Eau. This dam is 7,000 feet above sea level, and is reached after a long charabanc climb through the Forclaz Pass, by an ascent on a most remarkable funicular railway, rising 2,000 feet in about the same horizontal distance. The journey which takes half an hour is made on an open truck with no sides, an experience not quickly forgotten. Visits were also made to the stations of Orsiere and Sembrancher, the first named being still in course of erection. The chance of visiting a number of hydro-electric stations in quick succession gave opportunities for noting and comparing the methods adopted at the different stations in accordance with the particular local conditions, with quite interesting results. A visit of a lighter nature was made to a jam and fruit preserving factory at Saxone, where the party sampled the products and found them very good. The remainder of the trip, about two days, was given up to bathing, boating, and local sightseeing, and made a pleasant ending to a very enjoyable trip.

On the evening of the 27th the majority of the party left Glion on the return journey, leaving some of the party in Paris to visit the Colonial Exposition. Thus ended a most enjoyable tour, which was carried out in every way according to plan, and unmarred by any unfortunate accidents.

The gratitude and thanks of the party are due to all those Italian and Swiss engineers who showed the party round and helped to make the tour such a success, and particularly to Mr. Luigi Emanuelli, who was instrumental in arranging so many of the visits.

The organisation of the tour was in the capable hands of Mr. T. H. Lockett, assistant honorary secretary, I.E.E. London Students' Section.

Generation of Electricity, July, 1931

The official returns rendered to the Electricity Commissioners show that 785 million kWh was generated by authorised undertakers in Great Britain during the month of July, 1931, as compared with the finally revised figure of 786 million kWh in the corresponding month of 1930, or a decrease of 0.1 per cent. During the first seven months of 1931 up to the end of July, the total amount of electricity generated by authorised undertakers was 6,415 million kWh, as compared with the finally revised figure of 6,207 million kWh for the corresponding period of 1930, representing an increase of 3.4 per cent. In the same periods the production of electricity in the U.S.A. (based upon returns from some 70 per cent. of the supply industry) were: for July (five weeks), 8,150 million kWh, representing a decrease of 1.22 per cent.; and, for the first seven months of 1931, 49,655 million kWh, representing a decrease of 3.8 per cent.

E

Measuring Voltage Harmonics

The instrument described depends on a simple application of the resonance principle and enables the magnitude of voltage harmonics to be measured directly*

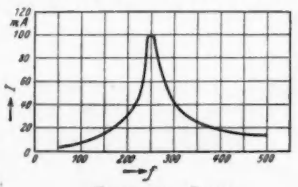
WHEN a voltage wave departs from the sine wave form, it is said to be distorted, and can be expressed in the well-known form of the sum of a series of sine waves of different frequencies. The instantaneous value of a wave of this type can be represented by the formula

$$u = U_{m_1} \sin(\omega t + \phi_1) + U_{m_2} \sin(2\omega t + \phi_2) + U_{m_3} \sin(3\omega t + \phi_3) + \ldots (1)$$

In the majority of cases met with in practice, particularly in heavy electrical engineering, the even harmonics disappear, so that the voltage wave can be expressed quite generally in the form

$$u = U_{m_1} \sin(\omega t + \phi_1) + U_{m_3} \sin(3\omega t + \phi_2) + U_{m_5} \sin(5\omega t + \phi_3) + \ldots (2)$$

In power station operation, the harmonics are a source of disturbance, and the usual method of evaluating them is to



Resonance Curve

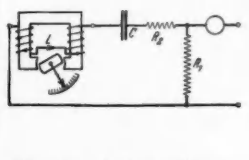


Diagram of Connections

photograph the complete voltage wave by means of an oscillograph. The magnitude and phase of each component wave is then calculated, by applying harmonic analysis, or by using a harmonic analyser. The whole procedure of obtaining the wave shape, and analysing it, is very long and tedious, and has the further disadvantage that it is impossible to obtain a continuous record of the wave form, and the harmonics in the wave.

It is possible, by making certain assumptions, to obtain the magnitude of each voltage harmonic by means of a direct reading instrument. It should be noted that the phase displacement of the harmonic cannot be obtained, but, in the majority of cases, this is not required.†

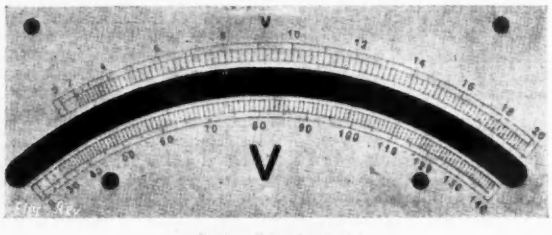
A Resonant Circuit

The necessary conditions are obtained approximately in a circuit designed to give voltage resonance, by connecting an inductance, capacity, and resistance in series. At resonance frequency, this circuit has effectively a small resistance, but, for all other frequencies, a considerably greater impedance—due to either capacity or inductance—is obtained. The resonance curve for a practical circuit of this type is shown above, where current is plotted against frequency, assuming the voltage is constant.

The result is approximate in that the current flowing in the resonance circuit is not simply that of the actual harmonic. The impedance of the circuit is certainly high for other frequencies, but it is not infinite. In this respect, in practice, the fundamental plays an important part, because with very few exceptions the harmonics are only a fraction of the value of the fundamental, and consequently the effect of the latter is considerably greater than that of the former. This error introduced by the fundamental will be considered first of all, other errors being neglected for the moment.

In an actual case, the resonance impedance for fifth harmonic (250 cycles) $R_5 = 196$ ohms, and effective impedance for fundamental with circuit tuned to 250 cycles $Z_{15} = 5{,}890$ ohms.

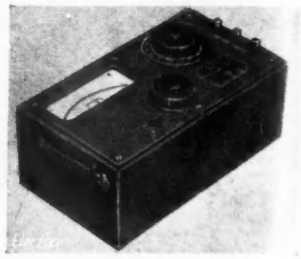
The instrument gave a full scale reading for approximately 100×10^{-3} amp., so that the range for the fifth harmonic was 20 volts effective value. A fundamental of 100 volts would cause a current $100 \div 5{,}890 = 17.0 \times 10^{-3}$ amp. to flow through



Scale of Instrument

the instrument. In measuring a fifth harmonic of 15 volts, instead of obtaining a current of $15 \div 196 = 76.6 \times 10^{-3}$ amp. we should have a current of $\sqrt{76.6^2 + 17^2} = 78.4 \times 10^{-3}$ amp.

Our scale reading would then give a value of 15.35 V corresponding to an error of 2 per cent. approximately. Thus, in separating a harmonic of 15 V from a fundamental of 100 V, the error amounted to 2 per cent. of the true value, which is less than that we should obtain when using the oscillograph and applying analysis. On the other hand, as the value of the harmonic decreases, the error increases quite appreciably. If this value were about 5 volts, the error introduced by the fundamental would then be approximately 20 per cent. of the true value. Fortunately, however, this source of error can be almost completely compensated.



Direct-reading Instrument

It is assumed that the current measuring instrument, when used for alternating current, has a square law characteristic, so that the turning moment is $Md = CI_2$ .....(3).

If this is produced by two currents of different frequencies, say, the fundamental and fifth harmonic, then $Md = C(I_1^2 + I_5)^2 \ldots (4)$; this can be split up into $Md = Md_1 + Md_5$, $Md_1 = CI_1^2$ and $Md = CI_5^2 \ldots (5)$, (6), and (7).

This means that the current due to the fundamental, or the turning moment produced by the current, can be compensated by a corresponding opposite moment exerted by the controlling spring. The reading can therefore be corrected if the pointer is so adjusted that, with the fundamental current alone flowing, the scale reading is zero.

Effect of Other Harmonics

We have still to determine whether in measuring, for example, the fifth harmonic, the currents of, say, the third and seventh harmonics affects the reading. In measuring the fifth harmonic, let the current indicated by the instrument have a value I_{5a} instead of the true value I_5, so that $I_{5a}^2 = I_5^2 + I_3^2 + I_7^2 + I_9^2$ (8) assuming that harmonics greater than the ninth can be neglected. Since the instrument is calibrated directly in volts, the calculation can be made in volts.

Then $$U_{5a}^2 = U_5^2 + \left(U_3 \frac{R_5}{Z_{35}}\right)^2 + \left(U_7 \frac{R_5}{Z_{75}}\right)^2 + \left(U_9 \frac{R_5}{Z_{95}}\right)^2 \quad \ldots (9)$$

R_5 = resistance of the circuit for the fifth harmonic to which the instrument is tuned.

$Z_{35}, Z_{75} \ldots\ldots$ = equivalent impedance for the third, seventh, &c., harmonics, with the instrument tuned for the fifth harmonic.

$U_3, U_5 \ldots\ldots$ = actual values of the third, fifth, &c., harmonic voltages.

U_{5a} = value of the fifth harmonic voltage as read on the instrument scale.

The total reactance and resistance values for the above case are as given in Table I.

TABLE I.

Frequency cycles.	Circuit tuned to— 150		250		350		450	
50	Z_{13}	5890	Z_{15}	5890	Z_{17}	5890	Z_{19}	5890
150	R_3	196	Z_{35}	1330	Z_{37}	1670	Z_{39}	2000
250	Z_{53}	1890	R_5	196	Z_{57}	678	Z_{59}	910
350	Z_{73}	4000	Z_{75}	800	R_7	196	Z_{79}	440
450	Z_{93}	6660	Z_{95}	1290	Z_{97}	471	R_9	196

If in equation (9) we substitute

$$\left(\frac{R_5}{Z_{35}}\right)^2 = 2K_{35}, \left(\frac{R_5}{Z_{75}}\right)^2 = 2K_{75}, \text{ \&c.,}$$

a simple calculation in which we make use of the approximation $\sqrt{1+2a} = 1+a$ will give us the following formulæ—

$$\left.\begin{aligned} U_3 &= \frac{1}{U_{5a}}\left(U_{5a}^2 - K_{53}U_5^2 - K_{73}U_7^2 - K_{93}U_9^2\right) \\ U_5 &= \frac{1}{U_{5a}}\left(U_{5a}^2 - K_{35}U_3^2 \quad K_{75}U_7^2 - K_{95}U_9^2\right) \\ U_7 &= \frac{1}{U_{5a}}\left(U_{5a}^2 - K_{37}U_3^2 - K_{57}U_5^2 - K_{97}U_9^2\right) \\ U_9 &= \frac{1}{U_{5a}}\left(U_{5a}^2 - K_{39}U_3^2 - K_{59}U_5^2 - K_{79}U_9^2\right) \end{aligned}\right\} \quad \ldots (10)$$

If the correction factors K_{35}, &c., from Table I are calculated, and these values introduced into equation (10), the simple corrected formulæ given below are obtained. (Values less than .02 are neglected.)

$$\left.\begin{aligned} U_3 &= U_{5a} \text{ (Correction inappreciable)} \\ U_5 &= \frac{1}{U_{5a}}\left(U_{5a}^2 - 0.03\,U_7^2\right) \\ U_7 &= \frac{1}{U_{7a}}\left(U_{7a}^2 - 0.042\,U_5^2 - 0.086\,U_9^2\right) \\ U_9 &= \frac{1}{U_{9a}}\left(U_{9a}^2 - 0.023\,U_5^2 - 0.099\,U_7^2\right) \end{aligned}\right\} \quad \ldots (11)$$

* From an article by E. Heuter in *E.T.Z.*

† Refer to "Aufnahme und Analyse von Wechselstromkurven," p. 29, by Orlich, published by Fr. Vieweg & Sons, Brunswick, 1906. "Dissertation Zurich, 1912," by Hanni. "Dissertation Berlin, 1917, p. 2, by Roth; published by Julius Springer, Berlin. *E.T.Z.*, 1926, p. 1233, 1923, p. 757; articles by Meldahl.

These formulæ give a simple and convenient method of correcting the readings obtained, but the uncorrected values can be used in the formulæ without introducing any appreciable error. If greater accuracy is desired, the largest measured harmonic with the smallest error is first corrected, then the next largest, and so on. With each calculation the corrected value already obtained is used in place of the value read from the scale. In most practical cases, this additional accuracy is unnecessary.

In its practical form, the instrument consists of a condenser C, an iron cored choke coil L having an adjustable air gap, and a current measuring instrument. A frequency selector switch enables the circuit to be tuned approximately for 150, 250, 350 and 450 cycles, by altering the winding of the choke coil. Fine tuning is carried out by altering slightly the length of air gap in the choke coil by means of a bridging piece whose position can be read from a scale. The practical difficulty lies in the construction of the choke coil. Saturation phenomena must be avoided, the loss must be kept very small, and the induction with a given connection and position of the core must remain unaltered. These conditions can be fulfilled in a suitably constructed instrument with a total weight not exceeding approximately 25 lb.; the dimensions are 14½ inches by 8¾ inches, by 8 inches high.

Practical Applications

The practical use of the instrument is made very simple. It is connected to the voltage supply under test, the frequency selector switch is brought into position, and the pointer of the instrument adjusted to zero. By moving the frequency selector switch, and the handle of the fine tuner, the circuit is tuned to the desired frequency; the value of the harmonic wave can then be measured directly. If special accuracy is required, the correction calculation given above must be made (the correction formulæ are given on the instrument). This is usually simplified in that the majority of the factors are negligibly small. In addition, a series resistance is included in the instrument, so that, by connecting to a third terminal, it can be used as a normal voltmeter.

Any difference in frequency of the fundamental wave from the normal value of 50 cycles per second produces a corresponding difference in harmonic frequency, but, as a rule, this is not important. With the present day customary variation of plus and minus 1 per cent., this error does not amount to more than 3 per cent.

Recording Instruments

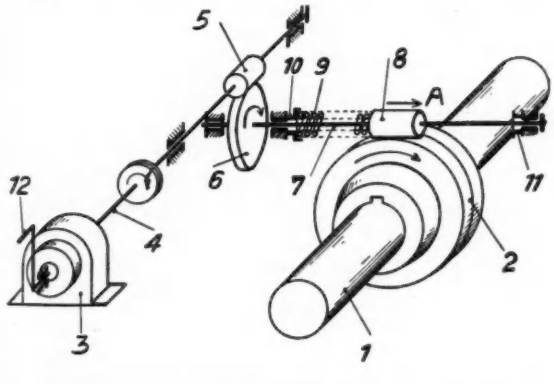
Finally, it should also be mentioned that recording instruments for measuring harmonics can be constructed on similar principles to the above. In certain cases experience has already shown that they can be of considerable importance. With the present extensive interconnection of power systems it is possible, under certain conditions of switching, to introduce harmonics into long lines of a network which are normally free from disturbance. The oscillogram only gives us information about the voltage wave at a certain given instant, so that such a disturbance, in spite of frequent control by oscillograph records, could remain undetected. It is practically impossible to keep a continuous record of the voltage wave by means of an oscillograph, whilst an instrument, such as the one described above, could be connected to the circuit and, where necessary, provide a graphical record.

Turbine Shaft Deformation

Precautions to be observed when shutting down large machines

IT is well known that when a steam turbine is taken off load, partial cooling of its inner elements commences and general cooling continues for many hours after the machine has been stopped. Measurements have corroborated results obtained by preliminary calculations that thirty-six hours, or more, elapse before the shaft of a large steam turbine reaches ambient temperature throughout.

If a turbine stands still whilst cooling down its shaft may temporarily become deformed and so render the good starting of the machine impossible; such great unilateral centrifugal forces will be set up that in most cases it will not be possible to attain normal speed without seriously jeopardising the machine. However, if certain precautionary measures are taken when closing down a machine and during the standstill, it is quite possible to obviate difficulties when starting again. A thick shaft, or a drum, is more liable to such influences than a smaller and more flexible one, and cooling down takes place unilaterally when the machine stands still, since the flow of heat from the warm mass of the stator and from the rotor to the inner and outer surroundings is asymmetrical to the axis of the shaft.



According to Mr. W. Schurter in the *Escher Wyss News*, the temporary bending of shafts has been repeatedly observed, but the shafts may be straightened by being heated with steam and allowed to rotate at a low speed (approximately 200 r.p.m.). Tests lead to the assumption that in cooling down a stationary shaft becomes deformed during the first 5 to 10 hours. As, however, neither a sufficient number of observations, nor a satisfactory explanation, is available to bear out this assumption, it must, for the present, be accepted that shaft bending is possible during the whole period of cooling down. Special investigations to clear up this matter have been in hand for some time.

The accompanying drawing illustrates diagrammatically a simple contrivance which has been designed by Escher Wyss and Co. for slowly turning steam turbine shafts during off-load intervals. One half of the clutch at the turbine end of shaft 1 is designed as a worm wheel 2. A small motor 3 drives a worm 5 on the shaft 4, which transmits the rotation at a greatly reduced speed to shaft 7 *via* the worm wheel 6. The worm 8, which still further reduces the speed, drives the worm wheel 2 and turbine shaft 1, the worm being so keyed on its shaft that it can readily be shifted in the direction indicated by the arrow A. The arrangement prevents the barring gear being driven at too high a speed from the steam end of the turbine shaft. When the latter commences to turn by being driven from a source other than the worm 8, the teeth of the worm gear 2 push the worm 8 so far in the direction A that it no longer engages. A spring 9 supported by the stop 10 then pushes worm 8 still further along until it reaches stop 11. In the event of the friction of the parts to be driven being greater than can be overcome by the starting torque of the motor 3, a crank 12 may be used. Thus to rotate slowly a turbine of 20,000-kW capacity, a motor of not more than 3 to 5 h.p. should be necessary.

The barring mechanism must be operated during each standstill, until the turbine shaft has cooled down completely. If only a lever and rack exist, the position of the rotor must be altered at intervals of 30 minutes at first, and later on of an hour, by about 45 degrees. Barring gear thus shortens the starting-up time of steam turbines. When the shaft is true, a turbine may be speeded up to its normal speed within a comparatively short time, but under no condition should the interior of the turbine be preheated whilst the machine stands still, as this is bound to give rise to shaft deformation. For the same reason sealing steam must never be admitted to the stuffing boxes when the shaft is at rest. Should vibration occur when a turbine is being started, the machine must be stopped, otherwise a " pacification " of the shaft cannot set in. After such a false start the turbine should be heated for some time whilst being rotated at a low speed.

The Telephone Service

In a letter to the public Press, Major H. L. Nathan, M.P., refers to the relatively small amount of space devoted to Post Office organisation in the Report of the Royal Commission on the Civil Service. He points out that most commentators on the Report seem to have overlooked the recommendation " that a special committee or commission should be appointed to inquire into the organisation of the Post Office." At first sight, he continues, this conclusion would seem to be unnecessary, as the Select Committee on the Telephone Service, whose Report was published in 1922, recommended reorganisation of the Department on commercial lines, reduction of telephone charges, commercial rebates to large users and extension of public call-boxes—recommendations as valuable to-day as they were nine years ago. He says that the transference of the telephones to an independent statutory authority, with power to float loans for development purposes in the open money market, is becoming so urgent as to warrant the immediate adoption of this item in the Report, *i.e.*, the appointment of a satisfactory committee—on which Civil Service representation must not be predominant—to report, promptly, on the practicability of the proposal.

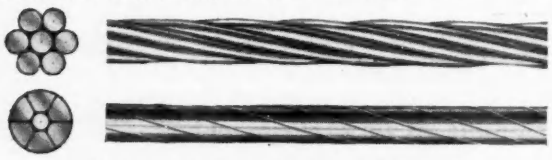
The Segmental-strand Conductor

A recently-developed type of conductor for overhead transmission lines which is claimed to possess many advantages over both solid and stranded wires of equal cross-sectional area

THE patent segmental-strand conductor has been developed with a view to reducing the cost of overhead lines, especially now that the more sparsely populated areas are being electrically developed. Previous reference has been made to its use in the ELECTRICAL REVIEW of September 19th (p. 467), and October 19th (607), 1930.

The chief advantage claimed for this segmental conductor, compared with the ordinary stranded conductor, lies in its smaller diameter, which approximates to that of a solid conductor; while still maintaining flexibility, it possesses greater strength than the solid conductor of equal area.

The smaller diameter of the segmental conductor allows of a considerably reduced loading. In climates where both wind and ice loadings have to be taken into account, there is a saving in the resultant loading, owing to the weight of the radial thickness of ice being less, and the projected area of the ice-loaded conductor being smaller. It is not possible to give a general figure for the resultant savings, as the wind pressure is proportional to the diameter, and the ice loading is a function of the square of the diameter. It may, however, be said that these savings vary from 10 to 25 per cent. under the normal regulations. In tropical climates, where wind pressure alone is considered, the pressure on the wires is lessened in the same proportion as the reduction in diameter of the respective conductors, thus affecting to a considerable extent the whole construction of the line.



Standard and Segmental-strand Conductors

Conductors and Towers

For equal maximum tension on the conductor under maximum loading conditions, the reduced loading by virtue of the smaller diameter will result in:

(*a*) A reduced sag for a given span and a smaller transverse load on the tower top, or,

(*b*) will allow a greater span, with equal sag and equal transverse loading.

If the conditions are as in (*a*) the height of the tower can be reduced for a given mid-span clearance, and this reduced height, with the reduced transverse loading, results in a considerably lighter tower.

If the conditions are as in (*b*), the towers will require to be of equal strength and height, but will be placed further apart, and will thereby be reduced in number.

In both these instances a considerable economy is claimed on the grounds that (i) the initial cost of each tower will be smaller, and therefore the total cost will be less; and (ii) by virtue of the smaller number of towers required their total cost will again be less; in each case an additional saving will be effected on erection and transport of material.

If the conditions are as (*a*) above, for both conductors and towers, the bulk of the foundation can be reduced.

If the conditions are as (*b*) above, the bulk of the foundation per tower will remain the same, but the number of foundations necessary will be fewer; therefore, in both cases the initial cost of concrete, excavation, and transport should be less.

Assuming that the conditions are as (*b*) above, and the towers are spaced further apart, the number of insulators necessary will be reduced, and in this way the number of points of possible breakdown lessened.

In either case inductance will be less, due to smaller diameter and, in addition, with case (*a*), where the sag is smaller, the conductor spacing can be reduced, and in this way a further reduction in the inductance of the line can be obtained. It may be expected, therefore, that the voltage regulation on any line constructed with the segmental-strand conductor will be better than with a standard stranded conductor.

Constructional Features

The segmental-strand type conductor lends itself more readily to ease and safety of construction than does the standard conductor. The conductor is pulled across country with greater safety, and is much less liable to damage in straining, and does not "birdcage" like the standard stranded conductor if the tension is suddenly reduced. It shows a considerable economy in tropical climates, where wind pressure alone is considered, and where steel towers with long spans are used; the longer the span, the greater the reduction in cost on the completed line.

In addition to the advantages outlined above, it should be noted that the resultant wind loading on a conductor of the type described, with its smooth surface, should be less than on a standard conductor, and it may, therefore, be assumed that a line carrying these conductors, designed with normal wind loads as applied to the standard conductor, will actually have a greater factor of safety than the theoretical figure on which the design is based.

A further economy to be expected by employing this conductor (in view of the fact that the towers will either be fewer in number or lighter in weight, and the foundation material less) is due to saving in transport.

It has been found in normal wood pole lines that the saving is over 12 per cent., and on this basis it is estimated that where all the above advantages are taken into account, the savings on a completed line, with steel towers, should amount to well over 20 per cent.

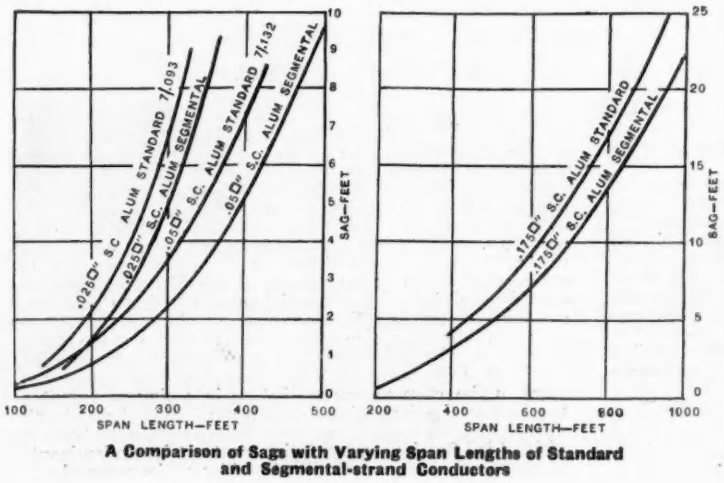
Comparison with Normal Conductors

It is particularly interesting to compare the ordinary stranded conductor with any of the segmental strand conductors. The saving in diameter of the segmental conductor compared with the seven-strand conductor of the same cross-sectional area is less than is the case if with strands of a greater number than 7, such as 19, 37, 61, &c. Where the size of conductor is reasonably large, and where the spans are long, the saving is quite appreciable.

Several overhead lines with segmental conductors have been erected in various parts of the country, but this is the first occasion on which a description of the system has appeared in the Press. The makers state as their experience that from the point of view of both cost and erection, the users show a marked preference for this type of conductor.

Examples of recent work are given below. Overhead, Ltd., have erected 27½ route miles of 0.06 sq. in. copper equivalent s.c.a., including 4½ miles double circuit, on a 33-kV line from Newcastle (Staffs) *via* Whitmore to Hookgate and from Market Drayton to Stafford, and 3½ route miles single circuit of 0.05 sq. in. copper equivalent s.c.a. for the Stoke Corporation; this line is being erected to the design of Mr. C. H. Yeaman, city electrical engineer, Stoke-on-Trent. Overhead, Ltd., have also constructed lines for the Wallingford and District Electric Supply Co., and between East Retford and Tuxford.

Callender's Cable & Construction Co., Ltd., have in hand the erection in the Staffordshire and Stoke areas of 6,300 yd. (single circuit) of 0.06 sq. in. copper equivalent s.c.a., 81,450 yd. (double circuit) of the same size, and 20,400 yd. 0.05 sq. in. copper equivalent s.c.a., all for 33-kV transmission. Johnson & Phillips, Ltd., have erected an 11-kV, 3-phase, 0.06 sq. in., copper equivalent s.c.a. overhead line for the Borough of Marlborough and Marlborough College joint electricity undertaking, and now have in hand the erection of the rural electrification scheme for the City of York, consisting of over 90 miles of 0.05 sq. in. copper equivalent s.c.a. conductor. This scheme will be erected to the order of Mr. E. J. Nichols, M.I.E.E., chief electrical engineer, York Corporation Electricity Department. The sole manufacturers are British Ropes, Ltd.



A Comparison of Sags with Varying Span Lengths of Standard and Segmental-strand Conductors

O.L.A. Conversazione

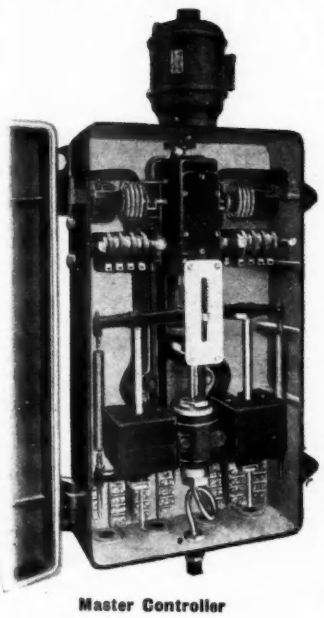
The annual conversazione of the Overhead Lines Association is to be held on Friday, October 16th, at Harrods, Ltd., Brompton Road, London, S.W.1.

Combustion Control Equipment

Describing a system of automatic boiler control with complete electrical operation, and some complementary instruments, etc.

IN the Siemens system of automatic boiler control which is being introduced in this country by Elliott Brothers (London), Ltd., at whose works at Lewisham the equipment will be manufactured entirely, the somewhat complex correlation of the various physical quantities which exist at any particular moment in a boiler is effected by a combination of electrical resistances. Many of the instruments, &c., are available individually and are already being manufactured.

The system provides automatic regulation for the supply of fuel and air, so as to maintain a constant steam pressure under varying loads, and the automatic controls are as follows: the fuel supply is controlled by varying the speed of the stoker or the pulverised-fuel feeder motors; the air supply is controlled by varying the opening of the air and flue-gas dampers or by varying the speed of the forced- and induced-draught fan motors, or by both in combination; the ratio of fuel to air (the fuel/air ratio) is controlled by an automatic CO_2 controller, and in some cases an additional $CO+H_2$ controller is fitted—an independent hand-operated regulator for adjusting the fuel/air ratio is also provided; there is also a control for the combustion-chamber pressure by means of an automatic pressure controller.



Master Controller

These controls are automatically adjusted to maintain constant steam pressure whatever the load, but by operating a switch the system can be instantly changed over to a condition of "constant output" in which the controls automatically maintain the boiler at a constant (pre-determined) steaming rate, independent of the steam pressure and condition of load.

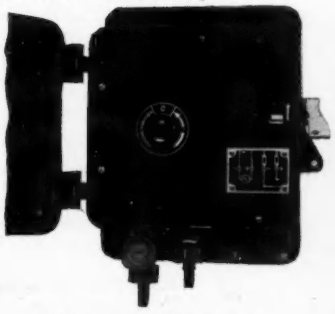
To convert the various mechanical or physical quantities involved into electrical quantities the "ring tube" resistance is employed. This consists of a sealed glass tube of about 3/16 in. internal diameter, bent into the form of a complete ring of about 3 in. diameter. The tube is filled with an inert gas and contains a platinum-iridium spiral occupying half the tube, the other half being filled with mercury. The resistance of the wire spiral is about 15 ohms, and the ends are brought through the glass by suitable electrodes fused in it. If the ring tube is rotated, the mercury will short-circuit some of the turns of the spiral, and the effective resistance will therefore be proportional to the angle of rotation. The variation in resistance for a given angular rotation is, of course, always exactly the same.

Control of Fuel and Air Supply

The correct relation between the principal automatic controls is maintained by the use of two Wheatstone bridges in which the variable resistance arms correspond to the steam pressure, fuel supply and air supply. The fuel bridge maintains the correct relation between the main steam pressure and the rate of fuel supply, while the air bridge performs the same service for the air supply.

The bridge circuit also deals with the fuel-air ratio adjustments for both automatic and hand, and also for "constant output" control. The necessary control devices employed for the simple bridge circuit are a master controller, bridge relay, differential draught transmitter, fuel-feed tachometer, pilot motors for the speed regulation of stoker and fan motors, and damper control motors.

The master controller consists of a very sensitive steam-pressure gauge, comprising a small piston, 7/16 in. diameter, both weighted and spring controlled, and kept in constant rotation by a small electric motor. The piston will respond to variations in pressure of about 0.5 lb. per sq. in.



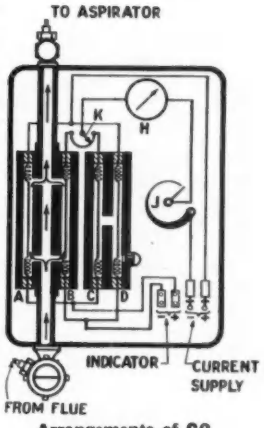
CO and H_2 Transmitter

The vertical travel of the piston rotates the ring tube resistances. The master controller is standardised to control four boilers, and there are therefore eight ring tubes, four for the fuel bridges on one side and four for the air bridges on the other.

Besides rotating the piston the electric motor operates the eight cams and contacts below the ring tubes, so that the control is not continuous, but operates on a step-by-step method, the time intervals being adjustable and arranged so as to give the various controllers time to act in order to avoid "hunting." The pressure gauge is not connected directly to the boiler, but to the main steam pipe or receiver some little distance from it, so that the measured pressure will always be less than that of the boiler and will depend on the pressure drop along the steam pipes, that is, on the quantity of steam passing. The variations of pressure are approximately proportional to the square of the steam flow, that is, of the load.

The bridge relay consists of a moving-coil system with two chopper bar devices which are depressed at short intervals by an electro-magnet connected to the timing device of the master controller. When no current flows through the moving coil, *i.e.*, when the bridge is balanced, the pointer remains between the two chopper bars and neither local circuit is closed, but when the pointer is deflected the chopper bar closes a circuit on either one side or the other, according to the direction of deflection. A separate relay is required for each of the two bridges.

The automatic differential draught transmitter is essentially a differential draught gauge of the "diving bell" type which is connected to two points in the flue. The vertical movement of the bell chamber actuates a ring tube resistance whose angular rotation is directly proportional to the difference of pressure and therefore to the square of the volume of flue gas passing.



Arrangements of CO_2 Transmitter

The fuel feed tachometer is a centrifugal governor type of speedometer, and is connected one to each of the stoker or fuel-feeder motors. It is fitted with a ring tube resistance which is actuated by a suitable cam and gearing, so that its angular rotation is approximately proportional to the square of the motor speed.

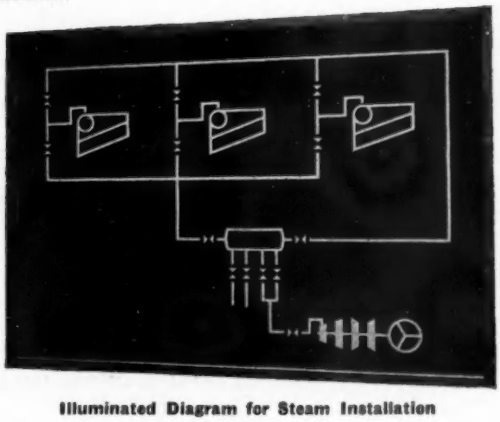
The pilot motors are connected directly to the bridge relays and are fitted with worm drives which vary the shunt field regulators of the stoker motors.

For the dampers a rather larger motor is fitted with a special reduction gear, so that the driving shaft can be directly coupled to the damper axle. The gear is fitted with adjustable cut-outs, so that the motor stops when any desired damper opening is reached.

For altering the fuel-air ratio either automatically or by hand a variable resistance is fitted in the fuel bridge and controls the fuel supply. The fuel-air ratio will then depend on the relative settings of the resistances in the two bridges.

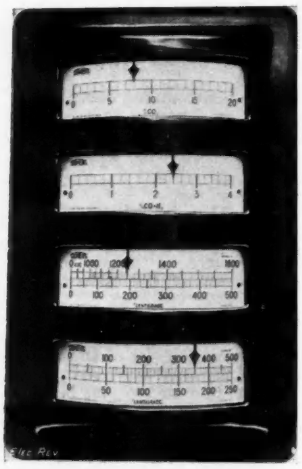
Automatic Control of Fuel-air Ratio

Automatic control of the fuel-air ratio can also be effected by the CO_2 controller. In this case an additional "cursor" resistance is fitted to the air bridge, and the setting of this resistance is automatically regulated by the CO_2 transmitter, so that its position depends on the amount of CO_2 in the flue gases at the moment.



Illuminated Diagram for Steam Installation

This transmitter consists of a weatherproof metal case containing the gas and air chambers and the Wheatstone bridge circuit, and in addition the rheostat J, milliammeter H, and the zero adjusting resistance K. The gas chambers A and B and air chambers C and D are drilled in heavy metal blocks to ensure that they are all at the same steady temperature. Each of the flue-gas measuring chambers is arranged as a shunt to the main line of gas flow, so that the gas can only reach the actual measuring chambers through two small holes which allow the velocity of gas flow to vary between fairly wide limits without appreciably affecting the temperature of the platinum wires. Each wire has a little platinum iridium spring soldered to each end to ensure that it is always kept in a true central position independently of its temperature, and the free ends of the springs are gold soldered to nickel pins fixed in insulating bushes.



Combined Set of Indicators

A small cartridge containing a special moisture-absorbing chemical is screwed to the hermetically closed air chambers C and D, so as to ensure that the air in these chambers is always dry. A milled knob controls the small sliding resistance K which adjusts the bridge arms to equality, and a second milled knob controls the rheostat J by means of which the milliammeter H is set to the red mark corresponding to 335 milliamperes.

The gas inlet at the bottom of the case is combined with a control filter containing cotton wool. This is fitted with a removable glass cover, so that the cotton-wool filling is always visible and its condition shows whether the main filter in the flue is in good working order. The gas outlet at the top has a very small orifice, so that the gas flow is throttled down to the correct amount when the aspirator is adjusted to give the correct reading on the draught gauge. The use of this "throttle orifice" necessitates a much higher aspirator suction than would otherwise be necessary, but this is an advantage as the effect of fluctuations in the chimney draught is thereby proportionately reduced and, in fact, is negligible under ordinary practical conditions. The electrical connections are made through the two watertight glands at the bottom of the case.

A meter available for indicating the total percentage of $CO+H_2$ in the flue gases is made up of the same parts as the CO_2 equipment, except that the transmitters are different and the indicators and recorders are calibrated in percentage $CO+H_2$. The principle of the meter depends on the measurement of the heat generated when the $CO+H_2$ content of the flue-gas sample is burnt in air to form CO_2 and H_2O. When the $CO+H_2$ meter is used in conjunction with the CO_2 meter the same aspirator, filters, &c., serve for both meters, the $CO+H_2$ meter being connected between the CO_2 meter and the aspirator; the same gas sample passes through both in succession. The $CO+H_2$ transmitter consists of a weatherproof metal case containing the combustion and air chambers, the Wheatstone bridge circuit, and the zero adjusting resistance. Both the gas inlet and outlet are at the bottom of the case, and combined with the former is the inlet nozzle for the air required for combustion. The dimensions of the gas chamber are arranged so that the normal gas velocity for the CO_2 transmitter is also correct for the $CO+H_2$ transmitter.

Automatic Control for Constant Output

By means of a change-over switch in the air bridge the hand-operated ring tube can be switched into circuit in place of the pressure-controlled ring tube. A similar switch is connected in the fuel bridge, and the two switches are mechanically coupled and operated by the hand control. When this change-over has been made the hand-control can be set to any desired position and the boiler output will then automatically be maintained at any required rate of steaming without reference to variations of load and steam pressure.

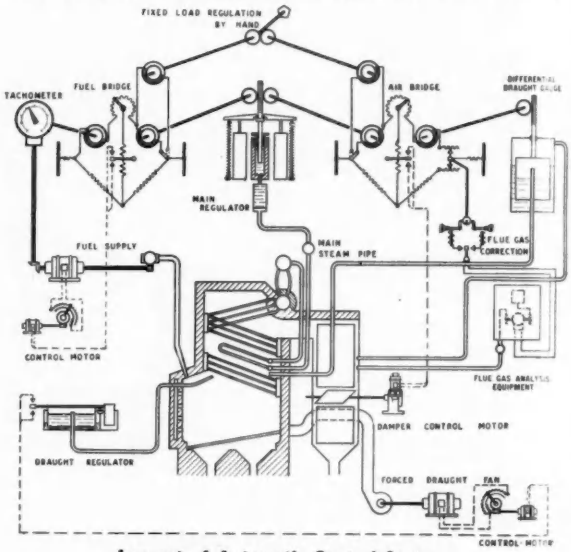
The control device for regulating the pressure in the combustion chamber consists essentially of a sensitive pressure gauge of the "diving bell" type and is fitted with a contact-making device somewhat similar to that fitted to the bridge relay. The bell chamber is connected to the combustion chamber and the contacts are directly connected to the damper control motor or to the pilot motor regulating the speed of the induced-draught fan motor, or to both. This instrument will respond to variations of pressure of 0.002 in. of water, and its action takes place in steps, the sequence being controlled from the timing device in the master controller.

The master controller, bridge relays, CO_2 controllers, &c., are usually fixed on a separate switchboard at some convenient central position, preferably in the boiler control room.

In order that obstructions or leakages in the boiler passes may be detected and uniform distribution of heat be secured, temperature measurements may be carried out by available thermo-couples or resistance thermometers.

The indicating instruments are of the ordinary moving-coil type and are connected to the bridge in the transmitter. Any of the indicators used with the thermo-electric pyrometers may, therefore, be calibrated in percentage CO_2 and may then be connected to a CO_2 transmitter. The connections are made by ordinary twin copper cable, so that the CO_2 readings may be taken at any distance from the actual point of measurement. The instruments may be housed in weatherproof metal cases, or they can be supplied suitable for flush mounting on a switchboard. An alternative type has four edgewise indicators combined in one case suitable for switchboard mounting. Such an arrangement is particularly useful where it is desired to take comparative readings of several different quantities quickly and easily. Any of the recorders of the "chopper bar" type may be calibrated for use with flue gas transmitters. Where desired a recorder may be connected in parallel with an indicator, the usual arrangement being an indicator fitted in front of the boiler and the recorder on the central boiler control panel or in the engineer's office. A convenient arrangement is a 6-colour recorder to show the CO_2 and $CO+H_2$ percentages and flue-gas temperatures of one or two boilers on one and the same chart.

It is often necessary to carry out a continuous estimation of the residual ash in the cleaned flue gases in order to obtain some reliable guide to the efficiency of dust precipitation, and this can be ascertained by the use of a smoke density meter. A steel tube with slots through which the gases carrying the particles of soot and dust pass is fixed across the flue. A high power electric lamp is fixed to the end of the tube outside the flue, and attached to the other end is an ardometer (total radiation pyrometer) on which the light rays from the lamp



Lay-out of Automatic Control System

impinge. The deflection of an indicating instrument connected to the ardometer is proportional to the reduction in light intensity caused by the particles of ash and coal dust. The soot content is indicated on an instrument with a "Ringelmann" scale on which different proportions of soot and dust are marked by differently shaded areas.

An interesting development is the representation of the lay-out of the working portions of water and/or steam systems in which measurements are made by an illuminated diagram on which the pumps, turbines and tanks are marked with symbols. Strips, representing the mains, and the symbols are illuminated from the back, the whole being incorporated in a suitable panel. The diagram is divided into a number of independent lighting circuits, each circuit commencing and finishing at a valve in the mains. Each valve is provided with a switchbox with mercury tip switches, the position of the switch on its axis corresponding to the position of the valve. On closing the valve the switch breaks the lamp circuit for the strip in the luminous diagram representing the section of the plant behind the valve. On opening the valve again the circuit is remade and the corresponding strip on the indicator is illuminated. The diagram can be switched off completely by a single switch on the front of the control board, so that it is possible to restrict the use of the diagram to emergency periods. The accompanying illustration shows the demonstration apparatus seen at Elliott Brothers' works. It depicts the h.p. steam system of an installation with three boilers, a steam receiver and a turbo-generator set.

Institution of Engineers and Shipbuilders in Scotland

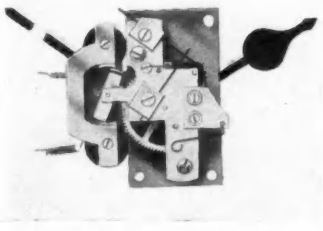
The Institution is to hold its "James Watt" dinner this year at the Grosvenor Restaurant, Gordon Street, Glasgow, on Friday, October 9th. Members may obtain tickets (£1 each) from the Secretary, Elmbank Crescent, Glasgow, C.2.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Improved Impulse-clock Movement

By the latest pattern "Pul-syn-etic" patent silent triangle movements introduced by GENT & Co., LTD., Leicester, for electrical impulse clocks, the sometimes objectionable half-minute "click" can be eliminated. The impulse mechanism, instead of being below the movement where it is in shadow, and consequently rather difficult for the worker to see, is arranged at the right hand of the movement and is fully accessible and visible. The ratchet wheel is at the right hand, and in this position one can see the precise action of the mechanism. This construction has also enabled the driving power to be increased, so that the mechanism is suitable for clocks for indoor positions even up to 12-in. dial size.



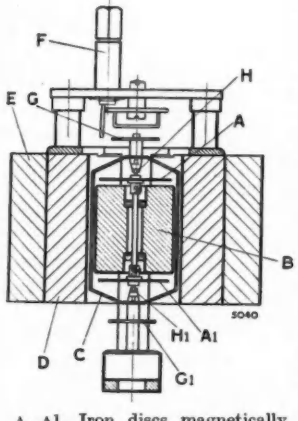
"Pul-syn-etic" Silent Movement

Connection Holders for Testing

For use when testing out complicated circuits such as in radio equipment, or where the wiring and terminals, &c., are very closely situated, J. J. EASTICK & SONS, Eelex House, 118, Bunhill Row, E.C.1, have introduced "Eelex" spring-loaded testing prods. The brass plungers, control springs, connections, &c., are contained in insulated housings (one red and one black) a trifle smaller than an ordinary fountain pen, and the prods are so constructed that the plungers can be locked in the extended positions, thus enabling one of them to be left in the sockets of a battery. The remaining prod can be moved from component to component, a slight pressure on the cap completing the circuit. The important feature is that all the metal parts are perfectly insulated until the point is placed on the terminal or wire to be tested and the cap pressed.

Pyrometer-indicator Improvements

Among the new features of the latest forms of thermo-electric pyrometers produced by the CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1, is the improved method of supporting the moving system of the pivoted-type indicators. The whole movement, together with its pivots, is held magnetically in the field of the galvanometer magnet, so that the movement "floats" as it were, on what is virtually an air cushion. This patented feature secures a degree of resiliency and resistance to shock which cannot be obtained by any other known method, such as the use of springs, &c. A further improvement is the provision of automatic cold-junction compensation in the indicators and recorders, rendering it unnecessary to note the cold-junction temperature or to adjust the zero.



A, A1, Iron discs magnetically suspended; B, Iron core; C, Coil; D, Pole block; E, Magnet; F, Zero adjustment post; G, G1, Control springs; H, H1, Pivots.

Moving System for Cambridge Pivoted Pyrometer Indicator

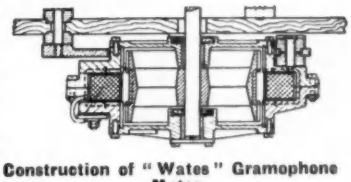
Tyre-repairing Equipment

The SIEMENS-SCHUCKERT WORKS CO., of Berlin, have recently introduced an electrically-heated vulcanising apparatus designed for repairing and retreading motor tyres from 4 to 6 in. in width. It consists of a split cast-iron mould, encased in heat-insulating material. A high-capacity heating winding of chrome-nickel wire is mounted between the cast-iron mould and the insulating material, being carried on ceramic insulators. The two halves of the mould can be moved relatively to each other, thus allowing for the accommodation of tyres of different widths. In order to ensure that the tyres make good contact with the moulds over the whole surface, aluminium reducing liners are inserted between the two halves of the mould. Eyes are provided in the upper part of the moulds to allow of the application of screw spindles for the purposes of pressing the tyre into the mould, the tyre having been filled out with a sandbag or inflated heating tube. The apparatus is mounted on a frame which carries the current terminals and four rotary switches for the control of the heating elements. The heating loading of the apparatus, which is arranged for direct connection to three-phase mains at 380 V, is 3.5 kW. The elements are sub-divided into four groups (two at the bottom and two at the side), each of which can be switched on individually. The input to the apparatus is automatically governed by a temperature regulator.

For repairs to the inside of motor tyres, an electrically heated mandrel capable of dealing with from 4- to 6½-in. tyres has also been introduced.

Synchronous Gramophone Motor

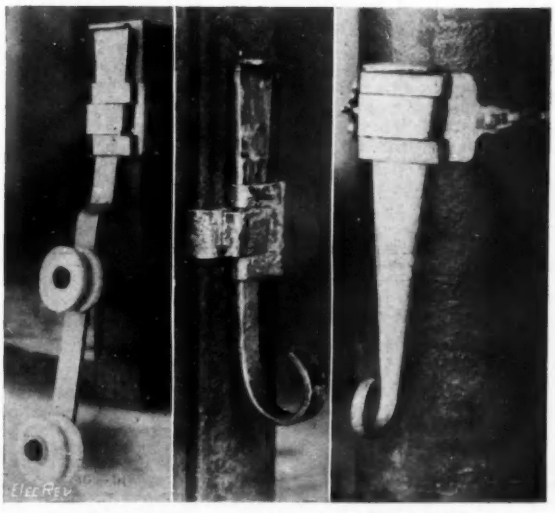
The "Wates" synchronous gramophone motor recently introduced by the STANDARD BATTERY CO., 184-188, Shaftesbury Avenue, W.C.2, is claimed to be of unique construction. It is designed for use on 50-cycle circuits only, so as to give an exact speed of 78 r.p.m. under all conditions. The motor is connected directly to the turntable without any governors, &c., but the table requires a slight start to commence it revolving. No brushes or commutators are used, and the apparatus is robust and simple. There is a large space available for winding a much stronger and thicker wire than is usual, so there is practically no heating; the power absorbed is only from 8 to 10 W. Current may pass through the motor when the turntable is stopped without damage. The motor is normally wound for 110 to 220 volts, but a 10 per cent. variation of voltage does not affect the power or speed. The apparatus is noiseless and especially adaptable for building in combined radio and gramophone outfits, the coil being enclosed in iron. With the use of an earthing wire any hum set up from bad mains can be avoided. Both bearings have comparatively large oil reservoirs. The flat construction requires the minimum of space, and mounting does not require skill, as a paper template is supplied with each model, complete with full instructions.



Construction of "Wates" Gramophone Motor

Cable-suspension Clip

In addition to other services the "Allgrip" clip which has been developed from the "Thor" clip by HASLAM & STRETTON, LTD., should prove useful for cable suspension from girders, poles, &c. Its feature is its simplicity, there being only three parts, which cannot be detached from one another. The three parts are a pair of sliding clips and a cotter or stem which is threaded through the clips. The stem is the carrying agent and has its bottom formed in the particular manner required—as a hook, or to take insulators, &c.; the top is turned over to form a driving head and to prevent the separation of parts. Due to the interlinking of the clips the further the stem is driven "home" the tighter the grip of the clips becomes. The standard suspension clip, type B, is the one recommended generally for cable work. It is sent out drilled for insulators, &c., and bent to specification. Type A clip, however, which is designed particularly for the suspension of safety lamps to flanged props and arches, offers many possible services in electrical work. In addition to the models mentioned the makers are also developing a clip for round and special props, the flange grips on the clips in this case being replaced by a chain encircling the prop.



"B," "A," and "Round-prop" "Allgrip" Clips

The Factory Report

The development of safety organisations has proved an important factor in reducing the number of accidents from all causes

THE Annual Report of H.M. Chief Inspector of Factories and Workshops (Sir Gerald Ellhouse, C.B.E.) for the year 1930* records that the total number of accidents reported has decreased from 161,269 to 144,758, and fatalities from 982 to 899. The decrease is no doubt in part due to industrial depression, but there has been a considerable reduction in those industries in which safety organisation has been most developed. Sepsis supervened in 15,011 cases with 49 fatalities; this suggests that first aid service is not properly utilised. The draft Safety in Factories Order has remained in abeyance following assurances by employers' associations that they would themselves take up the matter with their members.

The most disastrous nre (accompanied by the loss of several lives) occurred at a Luton hat factory. This was caused by the boiling over of a pail of beeswax, heated over a gas ring.

Lighting

The benefits to be derived from efficient illuminating systems are being rapidly realised, but much remains to be done in the way of education. Attention is drawn to the existence of varying bodies interested in the subject, *viz.*: two Government committees engaged in research—the Illumination Research Committee of the Department of Scientific and Industrial Research and the Committee on the Physiology of Vision of the Medical Research Council; the Illuminating Engineering Society, Inc.; the B.E.S.A.; the National Illumination Committee of Great Britain, affiliated to the International Illumination Commission, which is holding its triennial Congress in England next month; the Home Office Industrial Museum; and the service bureaux of the E.L.M.A.

TABLE I

Apparatus	Fatal	Non-fatal	Total
Electrical machinery	—	9	9
Transformers	3	3	6
Switchgear above 650 volts ...	—	22	22
Switchgear below 650 volts ...	1	109	110
Crane trolleys	3	16	19
Electric welding	—	14	14
Portable electric machines ...	—	15	15
Portable heaters and irons ...	—	12	12
Portable lamps	6	15	21
Fixed lamps	3	18	21
Cables and flexibles	2	62	64
Ignition of inflammable materials	1	3	4
Testing	1	36	37
Other apparatus	1	4	5
Total	21	338	359

In fine engineering works, lighting was unsatisfactory in 95 per cent. of old factories and 50 per cent. of those erected in recent years.

As an example of the effect of good illumination one case may be cited. In a large foundry the illumination was increased from two to seven ft.-candles and this resulted in a 7½ per cent. increase in the bonus earned by the workmen, who worked with less fatigue and were more contented.

Attention is drawn to the greater use of blue-tinted lamps (approximating in effect to daylight) and of pearl lamps, and to improvements in the lighting of extended areas, such as steelworks and docks. For fine process work, low-voltage lamps (10 to 16 volts) with small reflectors are sometimes used; these are supplied from double-wound transformers placed under the benches. The advantages obtained are freedom from risk of shock, lower candle-powers, and robust construction.

The Home Office Industrial Museum

Miss Hilda Martindale, O.B.E. (H.M. Deputy Chief Inspector) states that the exhibits in the museum are kept up-to-date by co-operation with the manufacturers. The air conditioning hut has enabled visitors to experience the immediate effects of different atmospheric conditions as influenced by temperature, humidity, and velocity of the air.

Different methods of wiring screw-cap lamp-holders are shown, all of which, except one, are incorrect. There is no danger from the cap when properly connected up.

The museum is proving a stimulus in the organisation of Safety and Welfare Exhibits outside London, and its value after three years is being more and more appreciated. It was visited last year by some 150 parties, some of which numbered between 300 and 400 persons. The most popular sections were those dealing with lighting, electrical and transmission machinery, lighting being easily first.

The Electrical Report

Mr. H. W. Swann, A.M.I.E.E. (Senior Electrical Inspector) records that 359 reportable electrical accidents occurred of which 21 were fatal, compared with 420 in 1929 (35 fatal). The average for the first five years has been 394 as against 364 for the previous five years. Table I sets out the accidents attributable to various kinds of apparatus. After low-voltage switchgear, failure of insulation of cables and flexibles is the most fruitful cause of trouble. Flexibles are usually left too long in service, and although extensive use is made of tough rubber sheathing, failures occur at entries to fittings, due to misuse of, or absence of, effective sheath grips. The incidence of accidents in various trades is indicated in Table II. Of 18 accidents to women, nine were due to defects in ironing apparatus. Electricians who have never experienced a severe shock are prone to underestimate the degree of danger; stamina does not appear to be much of a criterion, although the condition of the skin is very material. Many low-voltage fatalities are associated with "grip," *i.e.*, the clasping of live metal. Shock fatalities resulting from finger-tip contact (as with a live tumbler switch) are infrequent, the area of contact being small and the physical effect that of a jerk away. If, however, the hand and fingers encircle a live lamp-holder or electric drill, the area of contact is greatly increased and the physical effect is muscular contraction, so that self release is difficult.

TABLE II

Occupation	Fatal	Non-fatal	Total
Skilled:—			
Supervisory staff	2	8	10
Switchboard and sub-station attendants	—	12	12
Testing staff	1	22	23
Electricians, electrical fitters, jointers and mates ...	3	69	72
*Fitters, erectors and mates...	2	28	30
Unskilled:—			
Crane drivers	1	10	11
Other trades and grades:—			
(1) Men	7	133	140
(2) Male young persons under 21	5	38	43
(3) Women	—	18	18
Total	21	338	359

* Degree of skill not recorded.

Table III emphasises the risks attendant on comparatively low a.c. pressures.

With fatalities at high pressures death is not always instantaneous. Such accidents are almost invariably associated with heavy arcing causing serious injuries, to which the victims succumb.

A fatal accident, involving an inversion of the usual conditions, was caused by a man standing on damaged flexible who received a shock from his feet to earthed metal in his hands.

Defective Designs and Misuse of Apparatus

Lining metal boxes with a porcelain paint as an insulation appears to be of little value; incidentally, on account of the risk of internal arcing to the case, earth wires were found to have been removed from the boxes, in two cases by instructions from the local supply authorities.

On high-voltage ring-main systems where "wing-type" cubicle switchgear is used, there is often lack of provision for safe access to cable end boxes for testing purposes; this omission necessitates either work under dangerous conditions or the making dead of the whole switchboard, thus largely defeating one of the primary objects of ring-main construction. It should be more widely known that this point has been taken care of by several leading switchgear manufacturers.

TABLE III

System	Voltage	Fatalities
3-phase	33,000	2
	20,000	1
	440/400	4
1-phase	2,650	1
	250/200	12
D.c.	*	1
	Total	21

* A defective 500-volt switch ignited a quantity of petrol.

The true significance of the term "earthed" does not appear to be understood, especially in rural areas. Contractors and others should appreciate the fact that earthing connections are not inspected daily, and therefore the mechanical strength, proper methods of attachment, and prevention of corrosion are as important as conductivity.

Convictions were recorded in 20 out of 21 prosecutions taken. Fatalities were involved in 13 cases.

Co-operation with Consultants and Contractors

The southward drift of industry has led to the erection of a large number of electrically-equipped factories recently. The consultants and contractors have frequently outlined their schemes in advance to the Senior Electrical Inspector. This procedure, which has in many cases become a practice, saves both time and money, and has the additional advantage of bringing the Inspector's staff into touch at first hand with new ideas, new types of apparatus, and new schemes. Moreover, objections to compliance with regulations often disappear if it is possible to suggest a way of effecting it.

* H.M. Stationery Office, 2s. 6d. net.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

The British Industries Fair

This week the Department of Overseas Trade despatched to the more distant countries overseas the first of three letters which are to be sent to 55,000 individual trade buyers in over 100 countries, informing them of arrangements for the British Industries Fair, which will open in London and Birmiugham on February 22nd. The countries covered were Australia, New Zealand, China, Fiji, Indo-China, Japan, Persia, Siam, Dutch East Indies, Belgian Congo, Chile, and the Philippines, the languages used being English, Dutch, French, and Spanish. The letter, which was signed by Sir Edward Crowe, Comptroller-General of the Department, stated that there were indications that the coming fair would be of even greater interest to trade buyers than the last, additional important industries having now indicated their intention of participating.

Electricity Works Sequestered

The Las Palmas correspondent of *The Times* reports that this week the local Town Council has sequestered the local electric light works, which it is now running on its own account. Apparently there were originally two supply companies, one holding a concession for lighting only and the other a concession for power only. The two companies passed into the control of an American group some time ago; the station of the lighting company was shut down and electricity for lighting was supplied from the power company's station. This went on until recently, when the Town Council resolved to annul the concession of the power company for infringement of the conditions; to give the old lighting station 24 hours in which to start up; and, in default, to cut the cables connecting the two works and take possession of the whole of the property of the old company. No notice was taken of the ultimatum, and the threat was carried out. Diplomatic intervention is being sought by the American company.

America's Eye on Ireland

As a further indication of the interest which American suppliers of electrical goods are displaying in the possibilities latent in the Irish Free State, we are interested to see a whole illustrated page of the August *Electrical Merchandising* devoted to the recent Dublin Electrical Exhibition. A sad feature of the illustrations, however, is the prominence given to appliances of non-English manufacture.

New Australian Company

A company has been formed in Sydney, N.S.W., with a capital of £5,000 and the title "Barrier Broadcast, Ltd.," to establish and carry on a radio broadcasting station at Broken Hill, N.S.W.

British Engineers for Russia

Reuter (Riga) reports that a number of English engineers were among a party of fifty skilled workers, including Americans, Dutch and German, who passed through Riga this week on their way to Leningrad. The Soviet authorities are still engaging skilled workers from abroad to act as foremen in various industries in order to carry out the five-year plan. From Leningrad the party will go to "Svirstroy," the large electricity works which the Russian Government is erecting on the River Svir.

Metric Price-conversion Tables

In our issue of July 24th we noticed the first two of a series of equivalent tables, which gave conversions from English measures and currency into metric measures and the currencies of eleven Continental countries. We are asked to state that the publisher of these is Kingston's Translations Institute, West India House, 96-98, Leadenhall Street, E.C.3.

Teachers at the E.L.M.A. Bureau

As a part of the fortnight's course on "Electricity Applied to the Home" arranged by the Board of Education Summer School for Domestic Science Mistresses, a one-day course was given at the E.L.M.A. Lighting Service Bureau on August 10th. The visitors were received by Mr. C. W. Sully, Director of E.L.M.A., and the first lecture "How to give Lessons in Illumination" was delivered by the manager of the Bureau, Mr. W. J. Jones. This was followed by a talk by Miss D. M. Noakes on "Home Lighting." After lunch Mr. S. Anderson, B.Sc., spoke to the visitors on "School Lighting."

Met.-Vick. Work in South America

The Metropolitan-Vickers Electrical Co., Ltd., will shortly publish a special number of its *Gazette* dealing with the work which the company has done in South America. This will be of interest, as it follows the recent visit to South America of their Royal Highnesses the Prince of Wales and Prince George, with a consequent improvement in commercial relations. It is an opportune time to call attention to the large amount of British engineering, railway, and industrial work which has been done on the South American continent.

Great Britain's Radio Exports

Statistics published by the *Wireless and Gramophone Trader* show that during the first half of the current year radio apparatus to the value of £428,699 was exported from this country (excluding re-exports). This was comprised of valves valued at £132,697, receivers without valves £36,567, transmitting apparatus without valves £81,379, radio-gramophones, &c., £30,566 and other parts £147,490.

Russian Electrical Production

According to the Supreme Council of National Economy the achievements of the All-Russian Electrical Manufacturing Trust in 1930 included an increase in the production by 92.9 per cent. over the previous year. The work accomplished is stated to have included the construction of turbo-generators of 24,000 kW, and transformers for 15,000 V. During the six months ended with June, 1931, the production programme was only carried out to the extent of 87 per cent. In the current year's plan the construction of turbo-generators of 50,000 kW is aimed at.

"Mazda" Lighting Propaganda

The approach of winter is heralded by the receipt from the British Thomson-Houston Co., Ltd., of its plans for the 1931-32 lighting season. The company states that, in spite of the prevailing depression, the sales of "Mazda" lamps continue to increase, owing, it is claimed, to its effective publicity and sales organisation. Once again, the centre of the season's displays is the well-known "Dancing Girl," and she is seen in the illuminated window cut-out display which we illustrate. Above the picture are representations of the six sizes of pearl "Mazda" lamp, and across each are printed the wattage and the number of hours the lamp takes to consume one kWh. Other "sales aids" are a showcard dealing with "Mazda" automobile lamps, on the reverse of which are set out the voltage and type of lamp required for every make of motor vehicle used in the United Kingdom; a mascot for pasting on the rear window of a car; showcards, leaflets and booklets; and a well-produced lamp catalogue (48 pp.).

The 1931-32 "Mazda" Window Display

A Report on Latvia

A report on economic and trade conditions in Latvia, prepared by His Majesty's Consul at Riga, has just been issued by the Department of Overseas Trade. The report (C.3590) states that several branches of industry have suffered considerably as a result of keen competition, the lack of remunerative foreign markets, and a general fluctuation in prices, more especially during the first half of 1931. The general volume of business done is substantially less than in 1927 and 1928, both imports and exports having fallen in consequence of general depression and low prices. Imports of machinery, &c., amounted during 1930 to nearly 10 per cent. of the total imports, the value of which was 247,668,000 lats.

Hints for Commercial Visitors

A new number of the "Hints for Commercial Visitors" series, published by the Department of Overseas Trade, relates to Belgium (No. C.3590). It contains useful information with regard to methods of trading, customs, &c., as well as particulars of railway and air facilities.

Another memorandum of this series (No. C.3615) deals with Latvia, and besides general information useful to travellers, gives details of arrangements for touring and towns which should be visited.

Lighting and Power Regulations in Queensland

His Majesty's Trade Commissioner at Sydney has forwarded to the Department of Overseas Trade a copy of the Queensland Government Gazette of April 16th, containing "The Electric Lighting and Power Regulations of 1931." A copy of the regulations is available for loan to interested British firms, in order of application, from the offices of the Department, 35, Old Queen Street, S.W.1. Reference No. A.11065 should be quoted.

New Swiss Companies

Among the concerns recently organised in Switzerland are the Aneag Gesellschaft of Glarus, to acquire and develop patents in respect of l.p. electrical apparatus; the Vetriebs Gesellschaft für Radio und Schwachstrom Apparate, Glarus, to manufacture radio and electrical apparatus; the Société de la Fabrique de Lampes à Incandescence, Fribourg (20, Avenue de Gambach), to manufacture electric lamps; and the Société Sicam, Geneva (24, Rue du Vieux Billard) to carry on business as electrical and mechanical engineers.

Price Reductions

As from September 14th the FULLER ACCUMULATOR CO., LTD., is introducing reduced prices for almost all types of Fuller batteries, together with an increased trade discount on wireless batteries.

D.O.T. Market Memorandum

A confidential memorandum on the appointment of agents and the best methods to be adopted in trading with Portugal and Portuguese West Africa, compiled from information furnished by the Commercial Secretary to His Majesty's Embassy at Lisbon and the British Consul-General at Loanda, has been issued to firms whose names are entered on the Special Register of the Department of Overseas Trade. British firms desirous of obtaining a copy of the memorandum should apply to the Department, 35, Old Queen Street, London, S.W.1. Reference number C.X. 3591 should be quoted.

The Rotary Movement and the Electrical Industry

At the recent Congress of British Rotarians at Llandudno a special vocational meeting was held of Rotarians representing the electrical industry throughout the country. Most branches of the industry were represented at the meeting—manufacturers, distributors, contractors, municipal and company power suppliers. In dealing with the question of "Standards of Practice," a manufacturer advocated the allocation of definite discount classifications and a resistance to all efforts to secure a higher discount than that allocated, which, he suggested, should be based upon the measure of service rendered to the manufacturer and the community. There was much criticism of those manufacturers who were endeavouring to cut in behind their factors, offering overriding discounts for direct dealing. It was suggested that a stengthening of the trade associations was the best remedy for these evils.

It was agreed that the factors in most cases gave very useful service, but that there were exceptions in favour of well-advertised specialities where the demand was created by the manufacturer, who often provided the sales organisations and a service department. In discussing the "Relations between Employer and Employé," Whitleyism was advocated, and was held to be applicable to the electricity generation and distribution sections, but difficult of application to manufacturers not protected from keen outside competition. Pension schemes could be applied to staffs of almost all firms. With workmen the difficulty was the casual nature of employment in the contracting branch. The problems of methods of research and communication of results internally as between countries were dealt with at some length. It was felt that Great Britain as a nation was too secretive and should follow the lead of some other countries in open discussion of difficulties and of means for overcoming them.

New French Company

A new company has recently been formed in Mulhouse with a capital of £240,000 and the title La Société Transelectrique, to establish and work electric power transmission lines in Alsace.

New Catalogues and Lists

The MARTINDALE ELECTRIC CO., LTD., The Hyde, Hendon, London, N.W.9.—A 28-page illustrated catalogue of "Martindale" maintenance equipment, including grinding and turning tools, slot-cleaning outfits, and blowers.

CHARLES JOYNER & CO., Newtown Row, Birmingham.—List No. J.165, dealing with "Angelus" water-heating apparatus.

The QUASI-ARC CO., LTD.—An illustrated leaflet (S.P. 1092), giving particulars of the company's latest type "S.G." portable motor-generator welding set, designed for one operator.

L. G. HAWKINS & CO., LTD., 30/35, Drury Lane, Kingsway, London, W.C.2.—Leaflets, dealing with "Directolite" store-lighting fittings and the "Nektie" tie iron. Also the August issue of the "Link," containing information regarding the "Universal" electric waffle iron.

The MULLARD WIRELESS SERVICE CO., LTD., Mullard House, Charing Cross Road, London, W.C.2.—An illustrated broadsheet, giving preliminary details of the "Mullard 3" 1932 receiver kit.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, London, W.C.2.—Leaflet No. 1,135, illustrating and describing the Marconi type P.B.3 high-power broadcast transmitter, as used at the Raszyn station, Warsaw.

SIEMENS ELECTRIC LAMP & SUPPLIES, LTD., 38-39, Upper Thames Street, London, E.C.4.—Leaflet No. 905A, illustrating and describing "Siemens" fraud-proof house-service units.

The BIRMINGHAM BATTERY AND METAL CO., LTD., Selly Oak, Birmingham.—A booklet, relating to "B.B." condenser tubes in brass, cupro-nickel, aluminium-brass, and other alloys.

The EQUIPMENT AND ENGINEERING CO., LTD., 2 and 3, Norfolk Street, Strand, London, W.C.2.—An illustrated leaflet on the subject of practical magnetic analysis of iron and steel.

H. G. MOSELEY & CO., LTD., Eddo Works, Hospital Street, Birmingham.—Coloured folders, giving particulars of the company's latest types of "Eddo" electric fires, kettles, irons, and other domestic appliances.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.—Instruction charts, giving information regarding the assembly of the "Osram Four" radio receivers.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester. Folder No. 340, dealing with "Brookhirst" a.c. automatic control panels.

For Sale

Second-hand d.c. motors are offered for sale by St. Helen's Electricity Department.

Generators and rotary convertors are offered for disposal by Mr. W. H. Gillott.

Manchester Electricity Department invites tenders for the purchase and removal of one 100-kW induction motor generator set and two 150-kW synchronous motor generator sets.

(See our advertisement pages to-day.)

Trade Announcements

The Hull branch of the GENERAL ELECTRIC CO., LTD., has been removed to Magnet House, 164-8, George Street. (Telephone: Central 34625-6.)

Price-cutting Action

IN the Chancery Vacation Court on August 12th, Mr. Justice Farwell had before him a motion by the British Blue Spot Co., Ltd., against Mr. J. Butlin, of Brighton, for an injunction to restrain defendant from selling a "Blue Spot" loud-speaker unit below the authorised selling price.

MR. SHELLEY, for the plaintiff company, said the defendant appeared in person, and said he had nothing to do with the business at Brighton.

DEFENDANT said he was not the owner of the business. The owner was E. Butlin, and the business was carried on by E. Butlin. Defendant declared that he had nothing to do with the business.

His Lordship granted an injunction against J. Butlin and directed the matter to stand over as against E. Butlin.

COUNSEL said he would have E. Butlin served during the week.

His LORDSHIP said that in the case of J. Butlin the injunction would be in the terms of the notice of motion, and the costs of the motion would be costs in the action.

Aylesbury Borough Council's Electricity Charges

JUDGMENT was delivered recently by Judge Randolph, K.C., at the Aylesbury County Court in respect of a claim made by Messrs. Narbeth & Co., Ltd., a local firm of drapers, for £3 6s. 9d., alleged overcharges for electricity (ELEC. REV., July 24th, page 158). Of this amount the defendants had tendered £1 5s. 8d., as that part of the claim which they submitted had become due only after the action had commenced, but their cheque had been refused by plaintiffs, and returned.

His Honour gave judgment for the plaintiffs for 15s. 8d., with costs.

Irish Engineers and the Electricity Board

A meeting of the Irish Representative Council of Electrical Engineers was held in Dublin on August 16th, when correspondence with the Electricity Supply Board was read, dealing with the negotiations on salaries and conditions of service of the technical staff, having special regard to the Board's present concern with organisation and the delay which has taken place in coming to grips with the situation. The views of members covering the whole technical staff all over the Shannon Scheme were freely expressed. It was evident that there was keen dissatisfaction with the delay in formulating a permanent scheme of technical staff organisation, even though the difficulties of the Board were fully appreciated. The members present were unanimously of opinion that closer co-operation between the Board and its technical staff in the past would have materially assisted in averting some of the troubles of the Board. The officers of the Council were instructed regarding future action and as to the reply to be sent to the Board's communication.

Winding-up Petition

PORTABLE ELECTROPLATER, LTD.—A petition for the winding-up of this company has been presented to the High Court by J. H. Tucker & Co., Ltd., and will be heard in London on October 13th.

Meeting of Creditors

GRAMO-RADIO AMPLIFIERS, LTD.—Meetings of creditors and contributories August 25th, at 33, Carey Street, W.C.2.

Dissolutions of Partnership

LORD & ROBERTS, radio dealers, Poplar Buildings, Woodhorn Road, Ashington, and Catherine Street, Spennymoor.—Mr. H. P. Lord and Mr. G. N. Roberts have dissolved partnership. Mr. Lord will attend to debts and carry on the business.

A.L.G. RADIO SUPPLIES, radio dealers, 42 and 42a, King Cross Street, Halifax.—Mr. L. E. Seed, Mr. A. Ingham, and Mr. G. Ingham have dissolved partnership. Mr. Seed will attend to debts and carry on the business.

ELSTONS, radio engineers, 29, Upper Arcade, Bristol.—Mr. T. H. Elston and Mr. W. S. Handley have dissolved partnership. Mr. Handley will attend to debts and carry on the business.

WINSTANLEY & BARNETT, electrical engineers, 28, Paradise Street, Liverpool.—Mr. A. Winstanley and Mr. W. H. Barnett have dissolved partnership. Mr. Winstanley will attend to debts and carry on the business.

Wages in the Cable-making Industry

Recent falls in the cost-of-living index justify a reduction of wages in the electric cable-making industry on the third pay-day in September. The Joint Industrial Council for the industry has sent us a schedule of the rates which will then come into force. The reduction in the weekly wage amounts to about 2s. in the case of male timeworkers; 1s. 6d. in the case of youths and boys under 21; 1s. for women of 18 or over; and 6d. for girls.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.	Price Aug. 18th	Fortnight's inc. or dec.
a Acid, Oxalic ... per lb.	5¾d.	...
a Ammoniac, Sal ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Borax ... ,,	£17	...
a Copper Sulphate ... ,,	£25 10s.	...
a Potash, Chlorate ... per lb.	3d. to 4d.	...
a ,, Perchlorate ... ,,	5½d.	...
a Shellac T.N. ... per cwt.	£4 5s.	...
a Sulphur, Commercial ... ,,	£11	...
a ,, Roll ... ,,	£11	...
a Soda, Chlorate ... per lb.	3d.	...
a ,, Crystals ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	3½d.	...
METALS, &c.		
b Aluminium, Ingots ... per ton.	£85 to £90	...
b ,, Wire ... per lb.	1/1 to 1/9	...
b ,, Sheet and Foil ... ,,	1/1 to 2/9	...
b Babbits Metal and Anti-friction Metals—		
Grade I ... per ton net.	£113	£6 inc.
Grade II ... ,,	£81	£4 inc.
Grade III ... ,,	£68	£2 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	7d.	...
c ,, Tubes (solid drawn) ,,	9d. to 9½d.	...
c ,, Wire, basis ... ,,	7⅞d.	½d. dec.
c Copper Tubes (solid drawn) ,,	10d.	...
g ,, Bars (best selected) ... per ton.	£61	...
g ,, Sheet ... ,,	£64	...
g ,, Rod ... ,,	£64	...
d ,, (Electrolytic) Bars ,,	£38	...
d ,, ,, Sheets ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£48	...
d ,, ,, H.C. Wire per lb.	6½d.	...
f Ebonite Rod ... ,,	1/3 to 1/6	...
f ,, Sheet ... ,,	1/3 to 1/6	...
n German Silver Wire ... ,,	2/1	...
h Gutta-percha, fine ... ,,	nom	...
h India-rubber, Para fine ... ,,	4d.	½d. dec.
i Iron, Pig (Cleveland No. 3) ... per ton.	58/6	2/6 dec.
l ,, Wire, galve. No. 1, P.O. qual. ,,	£20	...
g Lead, English pig ... ,,	£12 15s.	£1 dec.
g Mercury ... per bot.	£16 5s.	15s. dec.
e Mica (in original cases) small ... per lb.	6d. to 3/6	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	8/6 to 17/6 & up	...
p Phosphor Bronze, plain castings ,	1/1½d.	...
p ,, ,, drawn bars & rods ,,	11d.	...
p ,, ,, rolled strip & sheet ,,	11½d.	...
p ,, ,, wire ... ,,	1/-	...
o Platinum ... per oz.	£8	...
d Silicium Bronze Wire ... per lb.	9½d.	...
r Steel, magnet, in bars ... ,,	7½d.	...
g Tin, Block (English) ... per ton	£116 to £118	£3 5s. to £4 5s. inc.
n ,, Wire, Nos. 1 to 16 ... per lb.	2/10d.	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
o Johnson, Matthey & Co.,
p C. Clifford & Son, Ltd.
W F Dennis & Co.

Bankruptcy Proceedings

W. M. Pratt and H. V. Clark (Magson Clark & Co.), electrical engineers, 165, High Street, Hornchurch, and 10, The Parade, South Benfleet, both Essex.—The adjourned first meeting of the creditors was held on August 13th at 29, Russell Square, London, W.C.1. According to the statement of affairs there were gross liabilities amounting to £2,744, of which £1,308 was expected to rank, against assets of £331, thus leaving a deficiency of £978. Debtors attributed their failure to lack of capital, bad trade at Benfleet, and heavy costs on judgments and executions. They became aware of their position in August, 1930. A resolution was passed for the appointment of Mr. Charles Latham, 78, New Oxford Street, W.C., as trustee of the estate, together with a committee of inspection. The following are creditors:—

	£		£
Falk Stadelmann & Co., Ltd.	401	Edison Swan Electric Co., Ltd.	105
National Electrical Supplies Co., Ltd.	156	St. Helens Cable & Rubber Co., Ltd.	57
Lighting Trades, Ltd. ...	218	Baxter & Caunter, Ltd.	87

Dodds (Harrogate), electrical engineers, Station Square, Harrogate.—The statutory first meeting of creditors was held on August 14th at the County Court Offices, 23, Victoria Avenue, Harrogate, when a statement of affairs was submitted which showed a deficiency of £2,920. The Official Receiver read a statement which he had received from Mr. Dodds, which said that he (Mr. Dodds) had been left to struggle on with the business, when a former partner had withdrawn. Mr. Dodds was unfamiliar with the technique of the business. The Official Receiver remarked that more information should have been forthcoming. The creditors decided to appoint Mr. C. H. Baker as trustee, with a committee of inspection.

W. G. Harden and C. H. Chinery (trading as Harden and Chinery), 7, Barnsbury Street, Islington, N., electrical and mechanical engineers.—The statutory first meeting of creditors was held on August 11th at London Bankruptcy Buildings, before Mr. E. Parke, Official Receiver. The receiving order was made on July 28th upon the petition of creditors. The liabilities are roughly estimated at £4,400, the failure being attributed to insufficient trade, bad debts, and losses on contracts. A resolution was passed for Mr. E. H. Hawkins, accountant, to act as trustee of the estate.

A. H. Start, electrical engineer, 6, Belle Vue Terrace, South Chard, near Chard, Somerset.—The public examination was held recently at the Municipal Buildings, Taunton. It was stated that the deficiency amounted to £52, and that the debtor was at present serving a term of imprisonment. The Official Receiver, therefore, asked that the examination should be adjourned until the debtor was released. The Registrar accordingly granted the adjournment.

L. Morris (a firm), 45-47, George Street, Baker Street, W.1, electrical engineer.—Under a receiving order made against this firm on August 5th, on the petition of a creditor, the statutory first meeting of creditors was held at Carey Street, London, W.C., on August 18th. No statement of affairs had been lodged but there was a proof of debt from the petitioning creditor for £51. The estate was left in the hands of the Official Receiver.

E. Dunn (H. Mitchell & Co.), gramophone and wireless dealer, 14, Edensor Road, Keighley.—Receiving order made August 6th, on debtor's own petition.

D. Makin, electrical engineer, 48, Dronfield Road, Pendleton.—First meeting held August 20th. Public examination, September 24th, at the Court House, Encombe Place, Salford.

T. W. B. Durant, electrical and motor engineer, 143, Wortley Road, High Green, near Sheffield.—Last day for receiving proofs of dividend, August 26th. Trustee, Mr. B. S. Briggs, 13, Burton Street, Wakefield, Official Receiver.

J. D. Waller, electrical engineer and contractor, 51, Park View, Ilkley.—Receiving order made, August 12th, on debtor's own petition.

J. E. Connell, electrical engineer, 29, Albemarle Road, Chorlton-cum-Hardy, Manchester.—Receiving order made August 12th, on debtor's own petition.

V. R. Shewan and A. L. Grace (Avon Radio Manufacturing Co.), wireless manufacturers, Long Ashton.—Last day for receiving proofs for dividend, August 28th. Trustee, Mr. J. D. Turner, 26, Baldwin Street, Bristol, Official Receiver.

W. H. Thornton, electrical and wireless engineer, 25, Bridge Street, Burnley.—Last day for receiving proofs for dividend, August 29th. Trustee, Mr. J. W. Carter, District Bank Chambers, Blackburn, Official Receiver.

D. C. Luen, wireless dealer, Cold Knap House, Barry.—Last day for receiving proofs for dividend, August 29th. Trustee, Mr. E. Owen, 34, Park Place, Cardiff, Official Receiver.

F. W. Cassell (F. W. Cassell & Co.), electrician, 164, Park View Road, Welling.—Last day for receiving proofs for dividend, August 29th. Trustee, Mr. C. J. Pyke, 280A, High Street, Rochester, Official Receiver.

Company Liquidations

Singapore Electric Tramways, Ltd.—Meeting, October 1st, at the offices of Messrs. Deloitte, Plender, Griffiths & Co., 5, London Wall Buildings, London, E.C.2, to receive an account of the winding up by the liquidator, Lord Plender.

North Surrey Electrical Factors, Ltd.—Meeting, September 14th, at the offices of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, London, E.C.2, to receive an account of the winding up by the liquidator, Mr. W. A. J. Osborne.

Blair & Co. (1926), Ltd.—Winding up voluntarily. Liquidator, Mr. H. J. Chambers, Mount Vernon, Barker Road, Linthorpe, Middlesbrough.

Samoiloff's Lighting Scheme, Ltd.—Winding up voluntarily. Liquidator, Mr. J. H. Liddle, Cranbourn Mansions, Cranbourn Street, London, W.C.2.

Dale's, Ltd.—Meeting, September 15th, at 155, Dale Street, Liverpool, to receive an account of the liquidator, Mr. M. Stone.

Electrical and Radio Products, Ltd.—Winding up voluntarily. Liquidator, Mr. D. L. Honeyman, 9, Basinghall Street, London, E.C.2.

Darlington Dry Battery Co., Ltd.—Winding up voluntarily. Liquidator, Mr. V. W. Heslop, 39, Priestgate, Darlington.

Loud Speaker Co., Ltd.—Particulars of this company's history and liquidation appeared in our last issue. The following are among the principal creditors:—

	£		£
Celestion, Ltd.	58	Kolster Brandes, Ltd. ...	104
Carrington Mfg. Co., Ltd.	61	McMichael, L., Ltd. ...	242
Colvern, Ltd.	52	Mullard Wireless Service Co., Ltd.	84
Ever Ready Co., Ltd. ...	59	Mainten Mfg. Co., Ltd. ...	63
Ferranti, Ltd.	69	Pye Radio, Ltd.	81
General Electric Co., Ltd.	110	Siemens Bros. & Co., Ltd.	68
Hunt, A. H., Ltd. ...	125		

Electricity Supply

Lighting, Domestic, Power

Australia.—SYDNEY.—In his report on the working of the municipal electricity undertaking for the year ended December 31st last, the general manager states that the total revenue for the year was £2,480,745 and the working expenditure £1,056,256, leaving a gross profit of £1,424,489. The corresponding figures for the preceding year were: Income, £2,549,685; working expenses, £1,241,241; gross profit, £1,308,444. After providing for depreciation, sinking fund, interest, and other charges totalling £1,399,792, there was a net profit of £24,697, which compares with £191,348 in 1929. This profit was appropriated as follows: Writing off of Bunnerong preliminary expenses, £2,955; general reserve, £21,701. Up to December 31st last a total of £17,339,341 had been spent on capital account and, in addition, a sum of £114,703 had been expended on construction plant at Bunnerong. Electrical energy generated increased from 360,848,400 to 410,151,500 kWh, the amount purchased declining from 66,435,900 to 569,678 kWh. Sales of electricity fell from 347,594,540 to 332,949,774 kWh, the decrease being largely due to a drop of nearly 27 million kWh in power consumption. The number of consumers showed an increase of 13,295, the total now being 194,565. The maximum supply demanded was 110,800 kW, as against 124,350 kW in the previous year. The average price obtained per kWh increased from 1.693d. to 1.725d. During 1930 arrangements were made with the New South Wales Government Railways and Tramways for a regular interchange of energy between White Bay and Pyrmont power stations so that generating plant at White Bay and at the Council's power stations could be utilised to greater advantage. The interchange commenced on October 7th as an experiment, and its continuance was approved by resolution of Council on December 1st, 1930. The installation of plant for the first section of the Bunnerong power station was completed during the year, but owing to the marked decrease in the demand for electricity, the delivery of an additional 25,000-kW turbo-generator for the next section has been postponed for a year. Preliminary steps towards making the change-over to a.c. in the centre of the city were taken during the period under review.

Balfron (Stirling).—SUPPLY FORTHCOMING.—The Grampian Electricity Supply Co., Ltd., is about to extend its mains to Balfron and Killearn, and it is anticipated that a supply will be available within the next six months. The cable will be extended from Aberfoyle.

Banff.—ELECTRICITY SCHEMES FOR HOSPITAL.—New electrical power and heating schemes are to be carried out at Chalmers Hospital at a cost of £3,000.

Batley.—YEAR'S WORKING.—In his report on the working of the electricity undertaking Mr. S. D. Jones, the electrical engineer, states that 272 new consumers were connected under the assisted wiring scheme, the total number of such consumers now totalling 1,722. In all there were 4,072 consumers at the end of the year. Although the sales of electricity decreased from 4,108,893 to 3,955,793 kWh, the year was one of active development with regard to future extensions.

Bedwas and Machen.—COOKER HIRING SCHEME.—The Urban District Council has decided to obtain 76 electric cookers to be let out on hire at 4s. and 6s. per quarter. Electricity for cooking will be supplied at 1½d. per kWh, except during the public lighting period when the charge will be 3d. per kWh. For this purpose a loan of £800 has been applied for.

NEW SHOWROOMS AND OFFICES.—Premises at Bedwas are to be rented for use as a showroom and for office accommodation.

Bexhill-on-Sea.—YEAR'S WORKING.—An increase of over 20 per cent., from 4,236,937 to 5,105,649 kWh, in sales of electricity, is recorded in the report of the borough electrical engineer, Mr. C. A. Frost, for the twelve months ended March 31st last. During the year 336 new consumers were connected, making a total of 4,870. The maximum demand rose from 2,581 to 2,901 kW. For the whole supply the revenue per kWh decreased from 2.18d. to 2.04d. The gross revenue amounted to £43,488, as compared with £38,680 in 1929-30, working expenses totalling £33,053 (£28,830). The gross profit increased from £9,850 to £10,435, to which was added income from other sources, making a total of £10,684 available. Loan interest, sinking fund, bank interest, &c., amounted to £10,885, there thus being a net deficiency of £201, as compared with £389 for the previous year. Capital expenditure during the year totalled £15,402, the amount spent on the undertaking at March 31st standing at £202,984.

Blackburn.—THE ASSISTED WIRING SCHEME.—The assisted wiring scheme, for which the Corporation Electricity Department has just applied for sanction to a loan of £17,950, provides for the wiring of houses for lighting, with one lamp in each room, with a maximum of eight lighting points. For a four-roomed house the tariff for four lights, one plug and one iron is 1s. 9d. per week, including 200 kWh of electricity per annum. For five lights, one plug and one iron, the tariff is 1s. 10d. per week including 200 kWh of electricity per annum. The lighting installation will be complete with lamps and shades, and one plug point will be provided for each installation, together with electric iron. The payments will be collected each week by a collector. The consumer will be able to pay off the balance of the cost of installation at any time.

Canada.—ANOTHER HYDRO-ELECTRIC SCHEME FOR THE ST. FRANCIS RIVER.—The Shawinigan Water and Power Company is reported to have completed plans for a hydro-electric power development on the Upper St. Francis River, about 70 miles south-east of Three Rivers, and to have made application to the Quebec Government for approval of the project. It is not yet known when construction is contemplated, nor the cost of the undertaking, though £500,000 is mentioned in the latter connection.

Cheddleton (Staffs).—INAUGURATION OF SUPPLY.—A supply of electricity was inaugurated recently by Alderman H. Leese. A group photograph taken on the occasion appears in the "Personal" column of this issue.

Clacton-on-Sea.—LOANS.—The Urban District Council has applied for sanction to loans of £3,560 for mains and services, £800 for meters, £1,500 for domestic apparatus, and £240 for the laying of a new main in Jackson Road.

Colchester.—OVERHEAD LINES TO HORKESLEY HEATH.—The Corporation Electricity Committee has obtained sanction to the borrowing of £1,992 for the construction of overhead lines to Horkesley Heath.

Dewsbury.—YEAR'S WORKING.—The Corporation electricity undertaking showed a net profit of £1,110 for the year ended March 31st last.

Douglas (I. of M.).—ELECTRICITY INQUIRY.—The committee appointed by the Town Council to conduct an inquiry into certain complaints made against the Electricity Department has now presented its report. The report states that the chief reason for the increased consumption of electricity by consumers in the March quarter was due to the longer period of 10 to 14 days in the quarter, owing to an alteration in the times of reading the meters made necessary by the increase in the number of consumers. The committee adds, however, that it is not altogether satisfied with this explanation, as it feels that there was a desire on the part of those responsible to inflate the yearly revenue in order to produce a better financial result from the year's working than was anticipated.

YEAR'S WORKING.—The accounts of the Corporation Electricity Department for the year show a credit balance of £733.

Dumfries.—NEW ELECTRICITY CHARGES.—The Town Council has adopted a two-part tariff for private residences, with a fixed charge based on the size of the house and a "unit" charge of ¾d. The charge for electricity for cinemas has been reduced to 4½d. per kWh for the first 2,500 kWh per quarter and 4d. per kWh beyond. The flat rate for motive power has also been reduced by ½d. per kWh.

Durham.—CATHEDRAL FLOODLIGHTING SCHEME ABANDONED.—The scheme for the flood-lighting of Durham Cathedral has been abandoned owing to the cost of the special cables required.

Hull.—EXTENSIONS.—The Corporation Electricity Committee has obtained sanction to the borrowing of £31,700 for the extension of the distribution system.

India.—HOOGHLY TUNNEL COMPLETED.—The tunnel under the River Hooghly, which has been under construction for the Calcutta Electric Supply Corporation for over a year, has now been completed.

Leeds.—LOAN SANCTIONED.—The Corporation Tramways Committee has obtained sanction to the borrowing of £5,800 for the provision of buildings and plant at the Headingley sub-station of the Tramways Department.

Mid-Cumberland.—ELECTRICITY SUPPLY PROSPECTS.—The Minister of Transport has sent a letter to Mr. A. C. N. Dixey, M.P. for Mid-Cumberland, in which he states that a representative of the local supply company was conducting a canvass of the district in order to ascertain the extent of the demand for electricity. A decision had been reached as to the most suitable point to which to bring a bulk supply from the Central Electricity Board and the terms of the bulk supply agreement were under consideration.

Morecambe.—CARNIVAL ILLUMINATIONS.—The Corporation Electricity Committee has reversed its decision and has now decided to spend £1,200 on the provision of illuminations for the coming carnival.

Newtown (Mont.).—ELECTRICITY SUPPLY SCHEME ADOPTED.—The Urban District Council has adopted, subject to certain alterations, a draft scheme for the supply of electricity to the town, submitted by the North Wales Power Co., Ltd. The Council desires that the scheme should be completed in one year instead of two and that steel poles should be used for the overhead cables.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

CLACTON-ON-SEA.—Two-part tariff: "Unit" charge reduced from 1d. to ¾d.

HAZEL GROVE AND BRAMHALL.—Minimum charge reduced to 30s. per annum—10s. for each of the two winter quarters, and 5s. for each of the summer quarters.

Radcliffe.—LOAN.—The Urban District Council is making application for sanction to the borrowing of £17,609, of which £5,000 represents over-expenditure of previous sanctions, while the balance of £12,000 is for estimated requirements in the next two or three years.

Retford.—NEW ELECTRICITY SHOWROOMS.—The Town Council has decided to rent premises in Bridgegate as electricity showrooms and offices.

Rhodesia. — POWER STATION FOR LIVINGSTONE. — The Northern Rhodesian Government, in the Legislative Council, has accepted a motion that immediate steps be taken to implement the recommendation of the Colonial Office technical advisers for the construction of a hydro-electric power station at Victoria Falls to supply Livingstone with lighting and power.

Salford.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (engineer: Mr. L. Romero) for the year ended March 31st last records a net profit of £27,373, an increase of £1,680 as compared with the preceding year's figure. Revenue showed an increase from £318,164 to £332,826, working expenditure amounting to £166,555, as against £164,758. There was a gross profit of £166,271 (£153,406), to which was added income from other sources, making a total of £173,998. Loan charges absorbed £138,796 and renewals £7,829. The year's capital expenditure was £80,230, the principal item (£38,593) being for l.p. mains and services; the total now spent on the undertaking is £2,384,645. In spite of considerable reductions in the consumption for power and traction, the total sales of electrical energy increased from 65,144,417 to 65,924,996 kWh; domestic sales rose by nearly two million kW to 7,852,723 kWh. The number of new consumers connected was 1,615, bringing the total at March 31st to 16,968. The maximum load increased from 26,400 to 27,000 kW. Installations provided under the assisted wiring scheme now total 258, of which 138 were carried out during the year.

Sheffield.—YEAR'S WORKING.—We have received from Mr. Ernest Morgan, general manager of the Corporation Electric Supply Department, a copy of the statement of accounts of the electricity undertaking for the year ended March 31st last. Revenue showed a decrease from £884,174 to £849,735, the working expenditure amounting to £431,532, as against £440,654 in 1929-30. The gross profit was £418,203 (£443,520), to which was added income from other sources making a total of £419,329 available. From this the following items had to be met: Income tax, £47,852; interest on loans, £142,997; and sinking fund, £173,980. There remained a net surplus of £54,500, which compares with £88,854 in the preceding year. Capital expenditure during the year amounted to £430,640, the total spent on the undertaking up to March 31st being £5,804,523. Sales of electricity for all purposes totalled 206,180,503 kWh, as against 223,984,191 kWh, the decrease being to a large extent due to a decline of 21,645,439 kWh in power consumption; domestic sales showed an increase of approximately 3½ million kWh. The comparison of the two years is affected by a change of method in the reading of meters, which has had the effect of an apparent loss of 4 million kWh in the sales of electricity. The maximum demand was 97,727, as compared with 95,384 in the previous year, the number of consumers rising from 68,695 to 83,583, an increase of 21 per cent. The average price obtained per kWh rose from 0.935d. to 0.976d. A Special Order was granted to the Council in February last authorising it to supply electricity in Dronfield and Beighton and by the end of March there were sixty consumers connected to the mains in these districts.

Stockport.—HIRE-PURCHASE SCHEME FOR COOKERS AND WATER HEATERS.—The Town Council has made arrangements for the supply of electric cookers and water heaters on the hire-purchase system at cost price, plus interest charges, payable in twelve quarterly instalments.

Stoke-on-Trent.—SUPPLY TO LONGPORT MILLS.—The Corporation Electricity Committee has agreed to provide a supply to Messrs. H. and R. Johnson, Ltd., at the Longport Mills at a cost of £1,700.

MAINS EXTENSIONS.—Mains extensions are to be carried out at a cost of £1,000 to afford a supply to the new stores of the Burslem and District Co-operative Society, Ltd., at Queen Street, Burslem.

BULK SUPPLY.—Arrangements have been made to provide a bulk supply of electricity to the Dairtfield estate at Trentham.

Whitby.—SUPPLY TO HOUSING ESTATE.—The Urban District Council has decided to give a supply of electricity to the Gallows Close housing estate, and to request the Housing Committee to provide electric wash boilers for the houses. The Council intends to offer special all-in terms for electricity to the tenants.

Wigton.—ELECTRICITY SCHEME.—The Rural District Council has agreed to co-operate with the Mid-Cumberland Electricity Co. in making a canvass of the district for prospective consumers of electricity, so that construction work can be carried out as speedily as possible. The proposed charges are 7d. per kWh for lighting, and 1½d. per kWh for domestic heating, with a special domestic tariff of 5s. per room per quarter, and a "unit" charge of 1½d. (¾d. after the consumption of 50 kWh per room per quarter), and special rates for power.

Worcestershire.—LIGHTING OF MARTLEY INSTITUTION.—The County Council Public Assistance Committee recommends the installation of electricity at Martley Institution, at a cost of £175.

Worksop.—YEAR'S WORKING.—The accounts of the Urban District Council Electricity Department (engineer and manager: Mr. M. S. Mason) for the twelve months ended March 31st last, show a total revenue of £26,518 and a working expenditure of £18,156, leaving a gross profit of £8,362. After providing for capital and other charges there was a net deficit of £1,376. Electrical energy sold totalled 2,907,755 kWh, the maximum supply demanded being 1,250 kW.

Traction

Algeria.—RAILWAY ELECTRIFICATION.—The Algerian Railway Administration, after exhaustive research on electrically-operated railways, has decided to electrify the Duvivier-Oued Keberid section of their system, a length of about 67½ miles. D.c. at 3,000 V has been adopted for feeding the railway network, the electrical energy being supplied from a private power station as high-pressure a.c. at 50 cycles, converted to d.c. at the railway sub-stations of Souk-Ahras, Oued-Damous and Medjez-Sfa. For this purpose seven motor generators each with a continuous rating of 2,500 kW (two-hour rating 3,750 kW) together with the requisite transformers and switching apparatus have been supplied by Brown, Boveri & Co., Ltd. The switchgear is arranged for automatic operation, the first unit of a sub-station being started up each day by means of a time switch adjusted according to the time table. The addition of further units is effected according to the energy requirements of the network.

Australia.—MELBOURNE.—Advance figures of the Melbourne Tramways Board for the year ended June 30th last indicate that the revenue will be approximately £2,059,000, a decrease of about £290,000, as compared with the previous year. There has, however, been a reduction in operating costs of about £263,000, the total being £1,396,000. After various charges have been met there is a balance available for reserves of £109,000, but as the Tramways Act requires that 4 per cent. of the capital cost of the undertaking be transferred annually to reserves the statutory deficiency for the year will be about £220,000. The corresponding figure last year was £169,939.

Continental.—RUSSIA.—According to a *Reuter* message, Moscow is to have an underground railway, the Central Committee of the Communist Party having decreed that construction of a railway beneath the city shall be begun next year.

FRANCE.—According to *Modern Transport*, a scheme to amalgamate the Paris underground railways, tramways, and 'buses into one organisation is to be placed before the Paris Municipal Council in October. The concession by which the Paris Transport Company operates the tramways and 'buses expires this year, and tenders are to be invited for its renewal.

SWITZERLAND.—Plans are reported to be under consideration for the electrification of the mountain railway between Alpnachstadt, near Lucerne, to the summit of Mont Pilatus. The line, which has been operated by steam locomotives since its construction in 1886-88, starts at a level of 1,443 ft. above the sea and rises to a height of 6,789 ft. The steam trains occupy 75 minutes for the journey, including stops for water, and it is estimated that by the adoption of electric traction this could be reduced to 33 minutes. Plans are also under consideration for the electrification of the local railway between Waldenburg and Liestal at an estimated cost of about £45,000.

HOLLAND.—The work of electrifying the railway between Amsterdam and Alkmar has recently been completed.

BELGIUM.—An electric railway will shortly be opened to traffic between Tervueren and the Quartier-Leopold station in Brussels. The trains will be composed of one motor coach and one trailer, or two of each, according to requirements. Each motor coach is equipped with four motors of 125 h.p. The collection is made from overhead wires which are supplied with direct current at 1,500 V, which is obtained from a sub-station fitted with mercury-vapour rectifiers for converting three-phase current received at 11,000 V from the Schaerbeek station of the Interbrabant Company.

Crewe.—AUTOMATIC TRAFFIC CONTROL.—The Corporation Watch Committee is to install automatic traffic signals at a cost of £793.

Railway Electrification.—SCOTTISH STOCKHOLDERS' PROTEST.—The Scottish Railway Stockholders' Protection Association has intimated that it is strongly opposed to any proposal for the electrification of the main lines.

Sunderland.—YEAR'S WORKING.—That the majority of the public prefer a modern tramcar to a modern 'bus is demonstrated from results that have been obtained from the running of an experimental single-deck tramcar in Sunderland, states Mr. Charles Hopkins, general manager of the Corporation Tramways and Motors Department, in his report on the working of the undertaking for the year ended March 31st last. The new tramcar was placed in service on March 11th, taking the place of a 'bus, and if its revenue per mile is any indication, its popularity was instantaneous and has been sustained. Mr. Hopkins adds that it must be remembered that this car is operating on a worn-out and dilapidated track. Passengers carried by the tramways during the year numbered 29,181,165, a decrease of 1,632,801 as compared with the preceding year, while the car mileage fell from 1,722,827 to 1,688,215. The revenue per car-mile declined from 17.58d. to 17.06d., the total revenue amounting to £122,657, as against £128,819 in 1929-30. Working expenditure increased from £105,873 to £108,003, leaving a gross profit of £14,654 (£22,947), to which was added the balance from the omnibus account (£8,747) and an unemployment grant (£131), making a total of £23,531 available. After making provision for capital and other charges, there remained a net surplus of £17,783, as against £18,272 in the previous year. During the year £32,182 was spent on capital account, the principal items being £1,563 for permanent way and £17,003 for 'buses; the total capital expenditure at March 31st was £475,367.

Telegraph and Telephone

Canada.—INTENSIVE TELEPHONE DEVELOPMENT.—Statistics of the system of the Bell Telephone Co. of Canada, recently published in the Montreal *Financial Times*, indicate that Canadians make more telephone calls per head than the inhabitants of any other country in the world. Next to Canada come the United States and New Zealand. In 1929 Canadians made 257.7 telephone conversations per head, the corresponding figure for the United States being 231 and for New Zealand 212. Denmark led the European countries with 148.6 conversations *per capita*, the figure for Great Britain being 32.1 and for France 19.1. In the provision of telephone facilities for cities of 50,000 people and over, Canada leads the world. With 23.3 telephones per 100 inhabitants in these communities its closest rival is the United States with 22.9. In the smaller towns and villages Canada ranks second to the United States, the figure per 100 people being 10.1 telephones, as compared with 12.1. Canada, with 1,399,986 telephones, ranks fourth in respect of the number of instruments installed, being exceeded only by the United States, Germany, and Great Britain. In Germany and Great Britain, however, the number of telephones per hundred persons is only 5.0 and 4.1, respectively. Canada, with 14.2 telephones for 100 persons, follows the United States, which has 16.4 telephones per 100 persons. New Zealand comes third with 10.3, followed by Denmark with 9.6, Sweden with 8.3, and Australia with 7.9 telephones per 100 persons. North America has 21,695,376 telephones, representing 62.84 per cent. of the world total.

Colombia.—TELEPHONE CONTRACT.—It is reported from Bogotá that a Swedish company has been awarded the contract for the establishment of a telephone service in the town of Honda

Hungary.—TELEPHONE ANNIVERSARY CELEBRATIONS.—The fiftieth anniversary of the invention of the telephone is now being celebrated in Hungary and special tributes are being paid to the memory of Theodore Puskas, whom Edison has described as "the first man in the world to suggest the central switchboard for the telephone." Puskas was the son of a noble but penniless Transylvanian family, who sought his fortune in the Colorado "gold rush." When he heard of the invention of the telephone, Puskas went to Edison with a plan for a telephone switchboard, and it is from this that the modern elaborate telephone exchange derives.—*Reuter* (Budapest).

Italy.—NEW CABLE TO SARDINIA.—The Italian Ministry of Communications is to lay a new telegraph and telephone cable from the mainland to Sardinia.

Overseas Telephone Services.—INCREASED USE.—Statistics published by the Post Office show that 1,827 transatlantic telephone calls were made during July between Great Britain and the United States. *The Times* states that many of these calls are attributed by the Post Office to the Hoover negotiations, but the figures show an increase over July, 1930, of 553 calls. The average number of calls made every month to the United States is 1,216. Record use of the overseas telephone was made in June, when British subscribers made on all circuits together a total of 46,203 calls. This was an increase of 5,908 over May and of 6,038 over April. Incoming calls from overseas numbered 58,797 during June, giving a total of 105,000 calls between Britain and other countries.

EXTENSION OF FACILITIES.—A direct telephonic service to Canada is promised by Post Office authorities in the near future. At present British telephone subscribers can communicate with Canada only *via* New York. Radio-telephone services to South Africa, India, and Japan are all receiving consideration, and plans are in hand for a circuit giving direct communication between London and Russia.

SERVICE TO FRENCH MOROCCO.—The General Post Office has now introduced a telephone service to all parts of French Morocco from all parts of Great Britain and Northern Ireland. The charge from any place in England, Scotland, or Wales is £1 7s. for a call of not more than three minutes' duration and 9s. for each minute or fraction of a minute after the first three. Subscribers in the Isle of Man or Northern Ireland have to pay an additional charge of 6s. for the first three minutes and 2s. for each subsequent minute. Hitherto the service to French Morocco has been restricted to London only.

Ship-shore Telephony.—A SWEDISH ENTERPRISE.—According to the *Telegraph and Telephone Age*, the Swedish-American Line, Goetborg, plans installing wireless-telephone equipment on its passenger steamers. The wireless telephone already has been used to a considerable extent in Sweden for maintaining contact with vessels in the Baltic, and for this particular purpose there are stations in Boden, Harnosand, Vaxholm, and Karlskrona. The Coast Guard Service of Sweden has installed connections between the lightships and the mainland. Sweden has no direct wireless telephone connections with foreign countries at present, but connection is made through the ordinary telephone cable between Sweden and Germany, whence it is transmitted by wireless to foreign countries.

Switzerland.—EXTENSION OF LUCERNE EXCHANGE.—The Swiss Telephone Authorities are applying for a credit of £17,000 for the extension of the telephone exchange in Lucerne, where the system is also to be converted to automatic operation.

Trunk Calls.—"ON DEMAND" SERVICE.—Birmingham is likely, the *Morning Post* understands, to be the first provincial centre to be linked with London by the equivalent of a toll call telephone service. This will be the first step in the Post Office scheme to speed up trunk telephone calls and to provid an "on demand" service, so that, excepting during abnormal rush periods, it will be possible for any subscriber in the country to telephone to any other without replacing his receiver. It is hoped to make a start with the scheme towards the end of this year, and the whole system will probably take from eighteen months to two years to complete. It is understood that work is also proceeding on the equipment of the lines connecting London with two other important cities, and that the introduction of similar facilities on these routes will follow shortly on the inauguration of the Birmingham service. Coincidentally with these developments, automatic apparatus will be installed on exchange switchboards for recording the times of trunk conversations. The records will begin when the distant receiver is removed, and will end when connection is broken either by the subscriber or the exchange.

Radio

China.—FIVE-YEAR RADIO PLAN.—Chinese railway stations—the favourite rendezvous of the population in their leisure hours—are to be the venue of a great loud-speaker campaign to urge the benefits of broadcasting, says the *Wireless World*. The province of Chekiang has gone so far as to organise a five-year radio plan, which the object of establishing a broadcasting system on a sound basis.

France.—LARGE NEW STATION.—The Paris correspondent of *World-Radio* says that it is anticipated that the new station of Radio-Paris at Essarts-le-Roi will be opened in October next and that it will be in full operation for the winter season. This station is situated about twenty-five miles from Paris, and will have an aerial power of over 85 kW.

RADIO TAXATION.—The same correspondent also states that the proposed taxes on wireless will consist of a tax on receivers and a separate tax on valves. There will probably be a certain amount of opposition to the latter impost, though the former will probably be paid without complaint, particularly as the intention is to collect it monthly, so that the amount will not be missed very much. This monthly collection, if approved, will be made by the postman, who will collect the amount of the tax and present the receipt.

SPECIAL CABLES FOR BROADCASTING.—France is now making wider use than hitherto of telephone cables which have been specially designed for frequencies used in radio broadcasting. Cables have been laid between Bordeaux and Paris, and Paris and Marseilles. Within a few months there will also be cables ready for use between Bordeaux and Toulouse, and plans already exist for the laying of similar cables between Paris and London and Paris and Brussels. The installation of the Paris-London cable will provide an additional link for the relay to this country of Continental programmes.

Germany.—NEW STATION.—A new broadcasting station, with a power of from 75 to 150 kW, is to be opened at Goldachof, near Munich, at the beginning of next year.

National Physical Laboratory.—STANDARD FREQUENCY TRANSMISSIONS.—In connection with the work of the Radio Research Board of the Department of Scientific and Industrial Research, waves of accurately-known frequency have been transmitted for some years past from the wireless station at the National Physical Laboratory for checking the calibration of wave meters and other apparatus. Up to this year the frequencies employed have been suitable for commercial purposes, but commencing on March 3rd last, at the request of the Post Office, arrangements were made for a standard frequency transmission to be sent out which enables owners of amateur experimental transmitting stations to enjoy the same facilities. This standard frequency transmission is made on a frequency of 1,785 kilocycles per second (168.6 metres), and is transmitted on the first Tuesday in March, June, September and December, commencing at 9 p.m. G.M.T. A limited number of leaflets dealing with these transmissions are available and will be supplied to amateur experimenters on application to the Secretary, Department of Scientific and Industrial Research, 16, Old Queen Street, London, S.W.1.

Radio Interference.—A GERMAN DECISION.—The Berlin Courts have recently decided that listeners are entitled to enjoy their radio programmes free from the atmospheric disturbances set up by electrical apparatus erected in the vicinity of their sets. A suit was brought by a listener in central Berlin, who complained that the electrical apparatus installed by a grocer to work a cold storage installation made such a disturbance of the ether in the neighbourhood that wireless reception was spoiled. The case went to a higher Court, which ordered the grocer to take steps to end the disturbance at his own cost, declaring that it was immaterial whether the apparatus was erected before or after the radio listener installed his set. A similar decision was recently given by a French court at Amiens.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Belgium.—BRUSSELS.—August 28th. Commune de Saint-Gilles. 8,000 m. of armoured cable of 10 sq. mm. section and designed for d.c. at under 750 V. Specification (Cahier des Charges) for 5 fr. from Service de l'Electricité, 40, Rue Fernand Bernier, St. Gilles.

SCHAERBEEK.—August 26th. Hôtel Communale. 6,500 m. of l.p. armoured cable. Particulars (Cahier des Charges), from Service de l'Electricité, Hôtel Communale.

Dorchester.—August 27th. County Hospital Committee. Electrical rewiring of Dorset County Hospital. Specifications from Lt.-Col. A. Brown, secretary, County Hospital, Dorchester.

Dumfriesshire.—August 28th. County Council. Electricity distribution scheme. (August 14th.)

Dundee.—August 24th. Corporation. Various works, including electric lighting, heating, and ventilating of new municipal offices. Specifications, &c., from the official quantity surveyor, 91, Commercial Street, Dundee (deposit £2 2s.)

Egypt (CAIRO).—October 8th. Prison Administration. Diesel engine driven generator for Abu Zaabal power station. (A.X. 11055.)*

October 28th. Department of Public Health. Electro-medical and X-ray apparatus for six months commencing November next. (A.X. 11069.)*

December 2nd. Ministry of the Interior. Complete power station for the town of Tantah. (A.X. 11066.)*

Farnworth.—September 5th. Electricity Department. House service type meters. (August 14th.)

Fife.—September 15th. County Council. Electric lighting at Kirkcaldy West School. Schedules (deposit £1 1s.) from Mr. G. Sandilands, architect, Education Offices, Kirkcaldy.

Hastings.—September 8th. Electricity and Public Lighting Committee. Overhead and underground lines. (August 14th.)

Hull.—August 25th. Education Committee. Installation of electric lighting at Beverley Road School. Specification and form of tender (deposit £2) from Mr. R. C. Moore, director of education, Education Offices, Guildhall.

Irish Free State.—CLONAKILTY, CO. CORK.—West Cork County Board of Public Assistance. Installation of electric lighting at County Home. Particulars from Mr. J. J. O'Crowley, architect, Secretary's Office, County Home, Clonakilty.

FERMOY, CO. CORK.—North Cork Board of Public Assistance. Installation of electric lighting in County Hospital. Particulars from the engineer, County Home, Mallow, Co. Cork.

Lanark.—County Council. Various works, including electric lighting, in connection with the housing scheme at Salsburgh and electric lighting and heating, of new wards and additions to nurses' home at County Maternity Hospital, Bellshill. Particulars from Mr. P. C. Smith, county housing and town housing engineer, 13, Clydesdale Street, Hamilton.

Lanchester.—Durham County Council. Installation of electricity at the Institution. Particulars from Mr. H. Jevens, clerk to the Council, Shire Hall, Durham.

Leicester.—September 1st. Corporation. Laundry equipment, including laundry machinery, power transmission gear, electric power and wiring, at the Swain Street Institution. Specification and form of tender (deposit £2) from Mr. A. T. Gooseman, city engineer and surveyor, Town Hall.

London.—BETHNAL GREEN.—August 31st. Borough Council. H.p. and l.p. cables. (August 14th.)

CENTRAL ELECTRICITY BOARD.—September 21st. Construction of site works, foundation works, &c., at Agecroft, Clarence Dock, Crewe, St. Helen's, Blackburn and Nelson. (August 14th.)

August 31st. H.p. switchgear and electrical installation work. (See this issue.)

September 21st. Construction of site works, foundation works, &c., at Oxford, Gloucester, Bourne Valley, Swindon, Newport and Plymouth. (See this issue.)

OFFICE OF WORKS.—September 15th. Electrical and mechanical engineering labour in Cardiff. (See this issue.)

Manchester.—August 28th. Electricity Committee. Switchgear, voltage regulators, &c. (August 14th.)

August 29th. Electric hospital bed lift at Withington Hospital, Nell Lane, West Didsbury. Specification from the superintendent of works, Public Assistance Offices, All Saints, Manchester.

Morocco.—Société de l'Energie Electrique du Maroc. Supply and erection of a 60,000-V transmission line 37½ miles in length to the south of Marrakech.

New Zealand.—WELLINGTON.—September 22nd. Post and Telegraph Department. 63 miles of v.i.r. wire. (A.X. 11039.)*

September 2nd. 100 telephone bell gongs. (G.X. 10562.)*

September 3rd. Telephone transformers, transmitters, earpieces, mouthpieces, &c. (A.X. 11007.)*

September 7th. Telephone cords. (A.X. 11043.)*

September 8th. 1,000 three-way telephone plugs. (A.X. 11066.)* 100 four-conductor cords. (A.X. 11046.)*

September 15th. Automatic dial mountings and resistance spools. (A.X. 11042.)*

November 19th. New Zealand Railways. Intercall telephone system between Christchurch and Invercargill. (A. 11060).*

Public Works Department. October 20th. Boosting transformers. (A.X. 11040.)*

Oswestry.—September 5th. Electricity Department. Cables, switchgear, transformers, &c. (See this issue.)

Plymouth.—August 26th. Corporation. Electrical materials, &c. Particulars from Mr. R. J. Fittall, town clerk, Municipal Buildings.

September 14th. Electricity Department. E.h.p. metal-clad switchgear. (See this issue.)

Portsmouth.—September 9th. Electricity Department. Cables (August 14th.)

Reigate.—September 5th. Corporation. Automatic traffic control signals. (August 14th.)

Rossington (near Doncaster).—September 5th. County Council. Electric lighting installation at new police station. Particulars from the West Riding architect, County Hall, Wakefield.

South Africa.—JOHANNESBURG.—September 28th. Railways and Harbours Administration. Electric lamps. (A. 11051.)*

CAPE TOWN.—September 16th. Oil-immersed capacitor and an automatic oil circuit breaker. (A.X. 11052.)*

PRETORIA.—September 25th. Town Council. Sub-station switchgear. (A.X. 11075.)*

September 18th. Town Council. Switchgear and auxiliary apparatus required in connection with the installation of one, or alternatively two, 12,500-kW sets. (A.X. 11037.)*

Staffordshire.—August 27th. County Education Committee. Electric lighting and power installations in schools. (July 31st.)

Sunderland.—September 14th. Corporation. Cable, wire, meters and lamps. (August 14th.)

Wakefield.—August 29th. West Riding County Council. Wiring for electric lighting at the County Hall. Specifications from the county architect, County Hall.

Installation of internal automatic telephones in the new Registry of Deeds. Particulars from county architect, County Hall.

West Ham.—September 14th. Education Committee. Installation of electric lighting at South Hallsville Senior, Cheshunt Road and Pretoria Road Schools, now in course of erection. (August 14th.)

Wick.—September 7th. Electricity Department. Boiler plant, turbo-alternator, condensing plant, rotary convertor, h.p. and l.p. switchgear, and accessories. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Australia.—New South Wales Railway Commissioners. Accepted:—

2,200-V ironclad drawout switchgear, portion of which will control the lighting and signalling of Sydney harbour bridge.—Ferguson, Pailin, Ltd.

2,300-V metalclad switchgear for Argyle sub-station (£1,164).—Ferguson, Pailin, Ltd.

Sydney Harbour Trust. Accepted:—

Electrical materials and fittings for six months ending December 31st next.—Siemens (Aust.) Pty.; Edison Swan Electrical Co., Ltd.; Noyes Bros. (Sydney), Ltd.; Warburton Franki, Ltd.; British General Electric Co., Ltd.; Australian General Electric Co.—*Tenders.*

Dunfermline.—Town Council. Accepted:—

Installation of electric lighting in 210 houses at Bellyeoman.—David Henderson, Glasgow.

Godstone.—Rural District Council. Accepted:—

Installation of electric lighting at the Isolation Hospital (£274).—Urban Electric Supply Co., Ltd.

Government Contract.—41 tons of lead-headed wall nails.—T. F. Snow.

Leeds.—Assistance Committee. Accepted:—

Electrical work at casual wards (£195).—J. Micklethwaite.

Lossiemouth.—Town Council. Accepted:—

Installation of two crude oil generator engines at the burgh electricity station (£2,284).—Ruston & Hornsby, Ltd.

Manchester.—Education Committee tenders. Accepted:—

Laying of cables at Styal Cottage Homes.—W. T. Glover and Co., Ltd.

Electrical installation at Northenden Council School.—R. Seddon & Sons, Manchester.

Ryde.—Urban District Council. Accepted:—

Electric air extractor for the Council chamber (£25 10s.).—C. Langdon.

Electrical work for the extractor (£18).—Isle of Wight Electric Light and Power Co., Ltd.

South Africa.—PRETORIA.—Town Council. Accepted:—

12,500-kW turbo-alternator and condensing plant.—C. A. Parsons & Co., Ltd.

Wakefield.—Public Assistance Committee. Accepted:—

Wiring public assistance offices (£55).—H. Smith.

Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of the makers of the following:—

"KOE SON" hair dryer.

"LITTLE MARVEL" electric aspirator.

Notes

Electric Clocks

A correspondent suggests that in the very near future there will be an opportunity for considerable business for manufacturers and factors in the supply of household electric clocks operated from the mains on a controlled frequency. The development of this important and profitable electric service will be affected very appreciably by the way in which the electric clock is presented to the public, and, as hardly any are yet in use, it seems desirable to consider this aspect.

Beginning at the proper end, assume that a consumer buys a clock from a jewellery shop (which is what will happen), and brings it home.

It can be connected immediately to some lighting socket, but that leads to trouble, because the switch near the door may be opened, or the socket may be wanted for a light, and in any case the untidiness of the flex from the lamp socket to the clock will irritate the seer.

And so we think of the power plug (if there is one in that room). The lead may be connected by an adapter plug, but the main plug may be removed. It may be connected to the base of the plug, but generally that means a wireman's job.

Another way is to wire direct from the main house service to the clock point, which involves 230-volt wiring and may require tubing, although very thin 230-volt wire is now available Still another way is to fix a small 230/10-volt bell transformer near the meter and fix 10-volt bell wire at 1d. per yard to the required clock points. Thus we have, perhaps, a 7s. 6d. transformer and, say, 1s. worth of bell wire to buy in addition to the clock.

It will be seen that some people may buy a 10-volt clock and a transformer as described, and others will buy a 230-volt clock, and, of course, the 10-volt clock will sometimes be connected, unknowingly, to the 230-volt mains. Therefore, every 10-volt clock should have a 230/10-V transformer included in its selling carton. The great thing is to meet the coming demand smoothly and comfortably for the public in this electric service which is so valuable.

The Metropolitan Hospital

In the *Times* of August 17th, there appeared a paragraph stating that owing to serious defects in the electrical installation at the Metropolitan Hospital, the whole institution is being rewired. As such a statement might cause a feeling of lack of confidence in electrical work, we approached the consulting engineers, Messrs. Murray Coombs & Richards, to enquire what was the nature of the defects discovered. They inform us that the old installation has given about thirty years of service without renewal, and that the cable insulation has now deteriorated to such an extent that faults are occurring. Although it was a conduit installation, it was of the slip-joint variety, and isolated lengths of conduit have occasionally been discovered at a potential of 240 volts to earth.

In spite of the serious financial plight in which the hospital found itself, the Committee decided that a new installation must be proceeded with at once. A specification was prepared and tenders called for, the successful tenderers being Messrs. Drake & Gorham, Ltd., who are now carrying out the work.

The installation includes the complete renewal of the lighting, heat, power, and wireless systems. A new automatic telephone equipment is also being provided, and the emergency lighting of the operating theatre is being modernised. The corridor and staircase lights are all to be controlled from a master switch, and are arranged so that, by a series-parallel control of equally loaded distribution boards, they may be illuminated at half voltage during the night hours. Series parallel switching is also used for the night lights in the wards.

Large Four-winding Transformers

Four-winding 3-phase 50-cycle Oerlikon transformers are being installed by the Ryburg-Schwärstadt Power Supply Co., Rheinfelden, Switzerland, having an output of 70,000 kVA when all windings are loaded at the same time. The capacity of each of the four windings is 32,500 kVA, with a no-load pressure ratio of 10.5 kV/48, 116±5 per cent., and 145±5 per cent. kV. The yokes which are about 16 ft. 5 in. long, were made in two lengths.

The arrangement of windings, which was fixed by the condition laid down that the ratio between the various short-circuit pressures should not be higher than 1 : 2, is as follows: Half the 10.5-kV winding is arranged next to the core, then follow, radially, the 116-kV, the 48-kV, the 145-kV and finally the second half of the 10.5-kV winding, which constitutes the outermost winding.

In order that all five concentric coils of a limb may be subjected to a uniform pressure, each coil is pressed independently against the rests on the lower yoke by means of six powerful steel springs, a dash-pot arrangement being adopted to deal with sudden short-circuit impacts. The bushings are a combination of the usual oil-filled type and of the condenser type. The distribution of potential in a radial and axial direction is such that there are no discharges right up to the point of flash-over.

The I.M.E.A. Moving

On and after September 1st the registered offices of the Incorporated Municipal Electrical Association will be at Room 503, Australia House, Strand, W.C.2.

Starlight to Start Machinery at Chicago Fair

According to *The Times*, the Chicago World Fair authorities are discussing a plan by which the rays of light from Arcturus which left that star 40 years ago, during the World Fair of 1893, may be captured, converted, amplified, and used to start machinery in the Hall of Science at the opening of the Fair on June 1st, 1933. It is hoped to accomplish this feat by collecting the light rays in a telescope and passing them through a photometer connected with an electrometer, which in turn will be connected with the switches controlling the machinery.

Visit to Brimsdown Power Station

On Friday last a visit was paid to the Brimsdown power station of the North Metropolitan Electric Power Supply Co. by Mr. W. W. Lackie, O.B.E. (Electricity Commissioner) accompanied by the administrative staff of the Commission. They were met at the works by Mr. Evelyn Boys, F.C.I.S., secretary of the power company, and were shown round by Mr. E. Zoller, resident engineer. They made a complete inspection both of the power station and of the 132-kV line of the Central Electricity Board in course of erection.

Fraudulent Extraction of Electricity

A fine of £2 was imposed on Albert Charles Bird. of Abbot's Barton Hotel, New Dover Road, Canterbury, at Canterbury Police Court for using electricity from the heating circuit for lighting purposes. Bird stated that he had done it in ignorance.

Fatality

A verdict of "Suicide while of unsound mind" was returned at the inquest into the death of Frederick Fairbanks Akam, aged 42, a labourer in the employ of the Cottingham Urban District Council, who was found in a field at the foot of a transmission pole suffering from shock and burns which proved fatal. Evidence was given that Akam had said that he was "tired of life," and had climbed to the top of the pole. There was barbed wire nine feet high round the foot of the pole, the cable being 25 feet from the ground.

Educational

REGENT STREET POLYTECHNIC, LONDON, W.1.—Three-year diploma courses in electrical, mechanical, structural and automobile engineering commence on September 15th at the School of Engineering. The Evening Department reopens on September 28th. Particulars of courses and entrance examinations may be obtained from the Director of Education. (See our advertisement pages to-day.)

Research on Space Heating

The Research Committee of the Institution of Heating and Ventilating Engineers was resuscitated last October for the purpose of organising a fund to assist the Government Department of Scientific and Industrial Research in its projected research on heating and ventilation at the Building Research Station, Watford. The work which has been carried out so far has aimed at the general elucidation of factors which determine the efficiency of heating in a building. In the course of this investigation work of great interest has been carried out on heat losses experienced with different methods of heating. At present, however, such work can only be carried on very slowly, because in the present experimental house all the effects of varying weather conditions upon heat requirements must necessarily be studied at the same time. It is not possible with so many variables to speed up such investigations, or to simplify conditions by the control of individual factors.

In view of these experimental difficulties, a proposal has now been made to construct at the Building Research Station a "Controlled weather house," in which the walls, floors, and ceilings of an experimental room of practical size are to be exposed to controlled conditions by enclosing the room within a larger structure, the temperature of whose walls can be artificially maintained. The estimated cost of the "controlled weather house" and its equipment is £1,800 to £2,000, and in order that a case can be made out for the undertaking by the Government of financial responsibility for the erection and maintenance of this new building, it is essential that the industry should prove its interest by contributing towards the cost.

The Institution has voted from its general funds a sum of £100 (spread over a period of five years) towards the building and equipment fund. The Research Committee has also received other promises amounting to date to £200 towards this fund, and the promise of investigating work in the new house to the value of £1,000 likewise spread over a period of five years. The Council appeals to members of the Institution and to the heating and ventilating and allied industries for contributions to the fund. Contributions and promises should be sent to the secretary of the Institution of Heating and Ventilating Engineers.

Appointments Vacant

Assistant station superintendent and sales engineer for Nottingham Electricity Supply Department.

Electrical engineer and manager for Bingley Urban District Council.

Assistant meter engineer for the West Gloucestershire Power Co., Ltd.

(See our advertisement pages to-day.)

The Illumination Congress Banquet

Readers are reminded that a banquet has been arranged to take place on Wednesday, September 2nd, in connection with the International Illumination Congress for the purpose of welcoming delegates from abroad. The banquet will afford an opportunity for them to meet representatives of the electrical industry. Mr. C. C. Paterson, President of the International Commission on Illumination will preside. It is hoped that all those associated with the lighting industry in Great Britain will make a special effort to attend and bring with them as guests ladies or gentlemen who are in sympathy with the aims of the Congress.

The banquet will be held in the ball room of the Dorchester Hotel, Park Lane, W., at 7.30 for 7.45 p.m., and will terminate at 10.0 p.m., promptly, in order to enable the delegates to take part in a tour of inspection of the illuminated streets. Tickets will be 42s. each, inclusive of wines.

This is the first occasion on which a banquet of this nature has been held in Great Britain, and we are sure that many of our readers will desire to be present. Applications for tickets should be addressed to Mr. J. S. Dow, 32, Victoria Street, London, S.W.1, as soon as possible, as seats will be allocated in order of application.

Sampling and Analysis of Coal

In August, 1930, the British Engineering Standards Association issued a draft specification for the sampling and analysis of coal for inland purposes. The specification has now been published in its final form (No. 420, 1931, price 2s. 2d. post free). There have been a few small additions to the original draft, and there has been a slight rearrangement of the method of determining calorific value; the specification is otherwise practically unaltered. In our issue of December 19th, 1930, we made some criticisms on certain of the details of the original draft; these comments would apply equally well to the final specification, but we do not propose to repeat them. It may be assumed that since the draft was issued, the methods proposed have been put to practical test by interested parties, and the fact that very little change has been made indicates the soundness of the principles on which the draft was based. Part I of the specification deals with the sampling of coal, and has been based on the work of Dr. E. S. Grumell and Dr. A. C. Dunningham, of Imperial Chemical Industries, Ltd. A special report on this work has been issued by the British Engineering Standards Association, and it should certainly be studied in conjunction with the specification by all who are concerned with the sampling of coal. In brief, the method of sampling stipulates the minimum number and size of the individual increments which go to form the gross sample according to the grading and ash content of the coal. Two important points are that the weight of the sample is independent of the total weight of the consignment, and that the accuracy of the sample depends rather on the number of increments than on their aggregate weight.

In Part II—Analysis—the method of preparing the sample for determination of moisture "as received" has been amplified. The definition of calorific value as determined by the bomb method has been made more exact. When the draft was prepared no satisfactory method for the determination of phosphorus had been evolved, and this position still obtains. The form in which the coal analysis should be reported is illustrated in Part III.

Since the preparation of the original draft a new series of British Standard test sieves has been standardised (B.B.S. No. 410, 1931) in place of the old I.M.M. standards. The new standard has been adopted in this specification, and the dimensions of the sieves in question are given in an appendix. The approximate metric equivalents of the English weights and dimensions are given for the convenience of those who prefer them. It is hoped that this Standard Specification will be adopted by both producers and consumers of coal, and that it will prove to be a valuable aid to the distressed coal industry.

The "Eric Robot"

Readers will no doubt remember the interest created when a man of metal opened the *Model Engineer* Exhibition in London nearly three years ago. Actually this ingenious piece of electrical apparatus was constructed to take the place of a high personage who was unable to be present. Since then he has been on tour both in England and abroad, and has acted as chairman at many exhibitions. He has attended several electrical exhibitions chiefly as an attraction, and it appears to be a very useful way of making such an exhibition an assured success. The owner and inventor of this automation is Mr. A. H. Reffell, 11, Guildford Park Road, Guildford, and electricity undertakings who are planning exhibitions this season and to whom the idea appeals, should get into touch with him.

Spontaneous Electrification in Coal-dust Clouds

The work described in Safety in Mines Research Board Paper No. 71, Spontaneous Electrification in Coal-dust Clouds, by S.C. Blacktin and H. Robinson (H.M. Stationery Office, 6d. net) is a continuation of that already reported upon in a previous paper,* and forms the concluding portion of a research on the self-electrification of coal-dust. Small-scale laboratory experiments show that high voltages are produced on well-insulated metal tubes through which a stream of air carrying coal dust and emery powder in suspension is passing. Sparks of an energy content sufficient to ignite methane-air mixtures may be drawn from the apparatus so electrified. Experiments carried out on a larger scale and in the open air show that the same effects can be obtained with a suspension in air of coal-dust alone, free from admixture with emery, passing through an insulated air-pipe, and that, with the three different kinds of coal-dusts examined, the dust concentration necessary to induce ignition of firedamp is extremely small, the speed of air-current being well within the limits of mining practice. These effects are only obtained when electrical and atmospheric conditions are highly favourable for the accumulation of the electro-static charges produced by the friction of the dust with air. Ducts conveying dust-laden air must therefore possess an extraordinarily high insulation resistance to earth if the electrostatic charge is to be retained on the system. Humidity of the atmosphere has an inhibiting effect on the production of high voltages on such ducts, probably by reason of increased surface leakage of the charge to earth. A minute leakage to earth has been shown to be sufficient for complete elimination of the electrostatic charge. Accidental contact of a mine ventilation-duct with earth at a number of places along its length, or a single deliberate "earth" connection, will provide leakage that will effectively prevent the accumulation of an electro-static charge on the duct, even though the conditions for electrification (*e.g.*, high air velocity, high concentration of dust in suspension, and low relative humidity of the atmosphere), may be otherwise favourable.

* S.M.R.B. Paper No. 43. "Spontaneous Electrification in Dust Clouds (with special reference to coal-dust clouds)," by S. C. Blacktin (1928).

Battery Locomotives in Mersey Tunnel

Constructional work on the three-mile tunnel beneath the Mersey, between Liverpool and Birkenhead, is now well advanced, and it is hoped to be able to open the tunnel for traffic toward the end of the year 1932. The question of

Distinguished Visitors in Battery-driven Locomotive used in Mersey Tunnel

transport within the tunnel and workings was one which called for careful consideration, and it was decided to use D.P. battery-driven electric locomotives. At one time 72 batteries were thus employed, but the number has recently been reduced to 50, as fewer locomotives are now required. Each battery consists of 24 Kathanode cells, type KB.23, having a capacity of 407 ampere-hours at the five-hour rate of discharge. The illustration shows Prince George, together with Lord Derby, Sir Thomas White (chairman of the Mersey Tunnel Joint Committee), and several of the tunnel officials, seated on one of the "toast rack" trucks attached to a locomotive, just commencing a journey through the tunnel, which he inspected a short while ago.

International Conference on Bituminous Coal

Twelve major topics for discussion at the Third International Conference on Bituminous Coal to be held under the auspices of the Carnegie Institute of Technology, Pittsburgh, Pa., U.S.A., November 16th-21st, 1931, are tentatively announced by Dr. Thomas S. Baker, president of the institution and organiser of the meeting. While the congress is primarily scientific in scope, this year, due to the desperate plight of the bituminous industry, particularly in America, emphasis will be placed on the economic side of the coal business. Thus, one section of the meeting will be devoted to a discussion of the competition between coal and petroleum, natural gas, and water power. The following are the subjects and the English speakers:—Cleaning and preparation: Mr. W. R. Chapman and Dr. F. S. Sinnatt; Hydrogenation: Messrs. J. Ivon Graham and D. G. Skinner; By-products: Professor A. W. Nash; Fertilisers; Low- and high-temperature carbonisation: Mr. P. C. Pope; Gasification: Dr. M. Barash, Mr. T. R. Tomlinson, Mr. G. M. Gill, Mr. N. E. Rambush, and Mr. L. H. Sensicle; Combustion; Railway and steamship fuel; Smoke abatement, dust removal and flue-gas purification; Origin, classification and properties: Prof. William A. Bone, Dr. E. S. Grumell and Prof. H. G. A. Hickling; Competition between coal and other fuels; Storage of coal; Miscellaneous papers: Dr. W. H. Cadman.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Sir Holberry Mensforth, chairman of the English Electric Co., Ltd., and a vice-president of the B.E.A.M.A., has resigned from the board of Dorman, Long & Co., Ltd.

Major R. McCreary, who has been appointed general manager of the Belfast City transport undertakings *(Photograph by Chas. H. Halliday, Belfast)*

Major R. McCreary was appointed general manager of the city tramway and omnibus undertakings by the Belfast City Council on August 13th. The salary is £1,000, rising by annual increments of £100 to £1,500 per annum. Major McCreary is 41 years of age and had a distinguished academical career, graduating B.A and B.Sc.(Eng.) at the Queen's University, Belfast. For a time he was on the staff of the Belfast city surveyor as assistant engineer in tramway construction and general municipal work. He then received a commission in the Royal Engineers (Special Reserve) and passed through general and railway engineering courses at Chatham and Longmoor. At the outbreak of the war he was appointed assistant adjutant at Longmoor, later becoming adjutant. From 1915 to 1919 he was engaged in railway construction in France, reaching the rank of major and being awarded the Military Cross. Upon leaving the Army in April, 1919, he was appointed permanent-way engineer in the Belfast Tramways Department in charge of 120 miles of single track. Since he has occupied that position, Major McCreary has been responsible for reconstruction, renewals, &c., costing £1,327,400. In February, 1930, the Tramways Committee placed on record its appreciation of Major McCreary's services. Major McCreary is a member of the Institution of Civil Engineers and also of the Institute of Transport and the Institution of Municipal and County Engineers.

Mr. J. K. Brydges, borough electrical engineer of Eastbourne, recently asked for an increase in his salary from £1,125 to £1,215. This was recommended by the Electricity Committee, but the matter has now been deferred by the Town Council.

Mr. H. Moss, hon. secretary of the Bradford Circle of the E.D.A. delivered a Faraday lecture at the Eastbrook Hall, Bradford, to the Young Men's Class, on August 16th.

Mr. G. H. Sammons has left the Hampstead Borough Council Electricity Department and has joined the Manchester Corporation distribution staff. He was previously employed by Messrs. Veritys, Ltd., Aston, and the Birmingham and Wolverhampton Corporations.

Mr. H. Breckell, senior assistant in the Swinton and Pendlebury electricity undertaking, has been appointed electrical engineer and manager of the Gainsborough Electricity Department, in succession to Mr. H. Haigh, who is taking up a similar post at Shipley.

Mr. F. Swarbrick, borough electrical engineer at Basingstoke, who is leaving to take up a similar position at Hove, has been presented by the members of the Corporation with a wardrobe as a token of appreciation of his successful management of the undertaking for a period of eleven years.

Mr. John Bland, of the staff of Ferguson, Pailin, Ltd., who was recently married, has been presented by his colleagues with a Westminster chiming clock.

Mr. H. Raine, electrical engineer to the Annfield Plain Urban Council, Durham, has had his salary increased from £260 to £310 per annum.

Mr. Bernard Price, O.B.E., chief engineer of the Victoria Falls and Transvaal Power Co., Ltd., has arrived in this country. He is one of ten South African delegates who will attend the British Association meeting.

Mr. J. V. O'Connor has been appointed by the Government of Victoria as a member of the Melbourne Tramways Board in succession to the late Mr. T. O'L. Reynolds. Mr. O'Connor is president of the Tramways Employés' Union.

Mr. F. Greenwood has been appointed Registrar of Companies and Registrar of Business Names by the Board of Trade, in succession to Mr. C. C. Gallagher.

Mr. J. Callander has been appointed manager of all departments of the Barrow works of Messrs. Vickers-Armstrongs, Ltd., being responsible to the managing director at Barrow and Newcastle-on-Tyne, Commander C. W. Craven.

Mr. W. D. Austin, formerly with the Peterborough municipal undertaking, was recently appointed control engineer in the Croydon Electricity Department.

Mr. W. G. Watson, the managing director of the well-known Australian electrical importing company, W. G. Watson & Co., Ltd., recently returned to Australia after a long tour of England and the United States, during which he arranged a number of new agencies.

Mr. G. L. Murray is the managing director of the recently-formed Mullard Radio Co. (Australia), Ltd., while **Mr. E. Dare** has been appointed general manager.

Mr. E. Murray Harvey, O.B.E., M.C., Commercial Secretary, at Santiago, Chile, is to succeed Mr. S. G. Irving as Commercial Secretary, First Grade, at Rio de Janeiro, and **Mr. A. J. Pack,** Commercial Secretary at Washington, is to succeed Mr. Harvey at Santiago, Chile. These changes are expected to take place early in October next. It is anticipated that **Mr. Irving** will take up his duties as Commercial Counsellor at Buenos Aires in the middle of September.

Mr. H. L. O'Heffernan, a Croydon radio engineer, has been awarded a special certificate in a contest organised by the American Radio Relay League to ascertain the most reliable station for two-way communication with the United States. He received more than double the marks awarded to the next best.

Mr. W. J. Arterton, until recently Midland Counties representative for Laurence, Scott and Electromotors, Ltd., has been appointed sales engineer in Central England for Messrs. J. H. Holmes & Co., Ltd.

The photograph which we reproduce with this note was taken on the occasion of the commencement of supply from the Leek transmission line of the North-West Midlands Joint Electricity Authority to the Cheddleton district in North Staffordshire. Those standing are: Mr. Willcock, district engineer of Callender's Cable and Construction Co., Ltd.; Councillor

A North-West Midlands J.E.A. Group

Furmston, vice-chairman of the J.E.A.; Alderman H. Leese, chairman of the J.E.A.; the Rev. W. G. Burgis, vicar of Cheddleton; and Mr. C. H. Yeaman, chairman of the Engineers' Committee of the J.E.A. Those seated are: Mr. Walker, of Callender's; Mr. C. C. Pimble, mains engineer; and Mr. F. Gurnly, district engineer of the Metropolitan-Vickers Electrical Co., Ltd.

Obituary

Mr. J. R. Le Fevre.—The death occurred on August 5th of Mr. James Robert Le Fevre, who was in the employ of Messrs. Laurence, Scott & Electromotors, Ltd. Mr. Le Fevre was 32 years of age.

Mr. E. Parkinson.—The death occurred recently, at the age of 70, of Mr. Edward Parkinson, who had been traffic manager of the Yorkshire (Woollen District) Tramways Co. for about 28 years. He was formerly at Bradford and St. Helens.

Wills.—The late **Mr. James Arthur Smith,** director of the British Insulated Cables, Ltd., and other companies, left estate valued at £76,487 (£57,199 net personalty).

Mr. Frank Bailey, engineer and joint managing director of the City of London Electric Lighting Co., Ltd., left estate valued at £79,958 (£75,138 net personalty).

The late **Mr. Thomas M. Colquhoun,** of T. M. Colquhoun and Co., Glasgow, left personal estate valued at £5,952.

Mr. Sydney R. Hare, electrical contractor, of Walsall, left £6,924 gross and £1,566 net personalty.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered

Independent Battery Co., Ltd.—Private company. Registered August 13th. Capital, £2,000 in £1 shares (500 8 per cent. cumulative preference and 1,500 ordinary). Objects: To carry on the business of factors in electrical and radio batteries, accumulators, complete radio sets, &c. The permanent directors are:—L. S. Lowe (chairman and managing director), Woodside, Great Horkesley, Colchester, Essex; and H. C. Treby, 38, Upsdell Avenue, Palmers Green, N.13. Registered office: 272, Camden Road, N.W.1.

Michael Black, Ltd.—Private company. Registered in Edinburgh on August 10th. Capital, £7,000 in £1 shares. Objects: To carry on the business of electricians, electrical, mechanical, motor and radio engineers, &c. The directors are: M. Black, 106, Haggs Road, Glasgow; A. Wober, 21, Nicholson Street, Glasgow; and Mrs. F. Black, 106, Haggs Road, Glasgow. Registered office: 80, Blythswood Street, Glasgow, C.2.

McGhee & Murray, Ltd.—Private company. Registered August 13th. Capital, £500 in £1 shares. Objects: To adopt an agreement with F. L. McGhee and to manufacture, install, repair and maintain electrical and other lifts, and hoists, heating and ventilating plant and apparatus, &c. The first directors are: F. L. McGhee, 312, Durnsford Road, S.W.19; and J. H. Murray, 63, Cloberhill Road, Glasgow, W.3. Registered office: Windsor House, 46, Victoria Street, S.W.

Glamor Lamp Co., Ltd.—Private company. Registered August 13th. Capital, £100 in £1 shares. Objects: To carry on the business of dealers in electric incandescent lamps, &c. The subscribers are: A. Kinge, 58, Montana Road, S.W.17; and E. R. M. Calder, 29, Gertrude Street, Chelsea, S.W.10. The first directors are to be appointed by the subscribers. Registered office: 57, Mansell Street, E.1.

Senator Electric Products, Ltd.—Private company. Registered August 11th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers and importers of or dealers in instruments in connection with wireless, sound amplifying and recording instruments, &c. The first directors are: A. Benfield, 58, Plympton Road, N.W.6; and L. Turower, 136, Anson Road, Cricklewood, N.W.2. Secretary: A. Benfield. Registered office: 6, Finsbury Square, E.C.2.

Irish Electric Securities Trust.—Private company. Registered in Dublin on August 6th. Nominal capital, £100 in £1 shares. Objects: To carry on the business of a trust and investment company, &c. The subscribers are: M. H. Skelly, 28, Upper Pembroke Street, Dublin; and Miss B. Swaine, 44, Waterloo Road, Dublin. The first directors are not named.

Turner & Hooke, Ltd.—Private company. Registered August 8th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in dynamos, motors, armatures, magnetos, batteries, transformers, &c. The first directors are: P. Turner, "Cleveland," Salisbury Street, Loughborough, and G. H. Hooke, 28, Florence Road, West Bridgford, Notts. Registered office: 5b, Bedford Square, Loughborough, Leics.

Sure Arc Electrode Co., Ltd.—Private company. Registered in Edinburgh August 7th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of electrodes for electric arc welding, &c. The directors are: Sir A. Lewis, 11, Queen's Road, Aberdeen; A. H. Wilson, 2, Albyn Terrace, Aberdeen; J. F. Proctor, 27, Milton Road, Wallington, Surrey (sales manager of the North Eastern Welding Co., Ltd.); and W. F. Proctor, 16, Bon-Accord Crescent, Aberdeen (manager of the North Eastern Welding Co., Ltd.). Secretary: W. F. Proctor. Registered office: Stell Road, Aberdeen.

Mansell Jarrett Co., Ltd.—Private company. Registered August 8th. Capital, £1,500 in £1 shares. Objects: To carry on the business of heating, cooling, ventilating, electrical, consulting and general engineers, manufacturers of, agents for and dealers in electrical apparatus, &c. The directors are: G. Mansell, 45, Priory Road, Chiswick, and R. Jarrett, Woodlands, Kent. Registered office: 67a, Holland Street, Blackfriars, S.E.1.

Wilson Ford, Ltd.—Private company. Registered August 10th. Capital, £1,000 in £1 shares. Objects: To acquire the business of armature winders and electrical engineers carried on by A. Ford and G. W. Wilson at Forman's Buildings, Nottingham, as "Wilson Ford & Company." The first directors are: A. Ford, "Strathdene," Plumtree, Notts., and G. W. Wilson, Wolds Cot, Plumtree, Notts. Solicitors: Day, Johnson & Boot, 8, Park Row, Nottingham.

Nitrolyte, Ltd.—Private company. Registered August 10th. Capital, £2,000 in 1,000 10 per cent. preference shares of £1 each and 20,000 ordinary shares of 1s. each. Objects: To acquire certain rights in a process used in connection with the manufacture of electrical accumulators, and to carry on the business of electricians, electrical engineers, manufacturers of and dealers in accumulators, batteries, dynamos, motors, lamps, switches, &c. The subscribers are: E. J. York, 4, Devonshire Road, Newbury Park, and A. W. Booth, 39, Sundridge Road, Addiscombe. The first directors are: R. N. Martineau, H. S. Eaton, and M. Hartnady. Registered office: Polebrook House, Golden Square, W.

F. T. Clark, Ltd.—Private company. Registered in Dublin, July 30th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless telegraph, telephone, and optical apparatus, &c. The subscribers are: F. T. Clark, 46, Oakley Road, Ranelagh, Dublin, radio engineer, and P. Cullen, 4, Castle Avenue, Clontarf, Dublin. F. T. Clark is the first director. Secretary: P. Cullen.

Effect Radio Co., Ltd.—Private company. Registered August 4th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers and merchants of radio and electrical goods and parts, &c. The directors are: H. A. Turler, 18, Broughton Avenue, N.3, merchant; Margaret E. Gilligan, 135, Rosebery Square, E.C.1. Registered office: 57a, Holborn Viaduct, E.C.1.

Shaftesbury Radio Sales, Ltd.—Private company. Registered August 6th. Capital, £100 in £1 shares. Objects: To carry on the business of dealers in and producers of radio sets, radio gramophones and all component parts, to buy and sell for cash or on the easy payment or hire-purchase systems, &c. The subscribers are: A. G. Shaw, 5, Carlyle Mansions, The Mall, S.W.8; D. R. Harris, 31, Braemar Avenue, Wimbledon Park. Solicitors: Gordon Gardiner Carpenter & Co., 7, Serjeants Inn, E.C.4.

Eltra, Ltd.—Registered as a private company August 4th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio and electrical apparatus and accessories, electricians, electrical engineers and contractors, &c. The first directors are: W. Rosenberg, Dr. I. G. Subkis, Dr. N. Subkis, and S. Roschko, all of Berlin, and R. C. Black, Ulster Chambers, 168, Regent Street, W.1. Registered office: 168, Regent Street, W.1.

Simpsons Electricals, Ltd.—Private company. Registered August 14th. Capital, £11,000 in 10,000 10 per cent. cumulative preference shares of £1 and 20,000 deferred shares of 1s. each. Objects: To carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical appliances, wireless and radio sets, etc. The subscribers are: J. A. Trevenen, Byways, Mymms Drive, Brookman's Park, Herts., solicitor, and two others. The permanent directors are: D. Simpson and J. W. Simpson. Registered office: 11, Jewry Street, E.C.3.

Returns of Electrical Companies

Hightensite (1930), Ltd.—Satisfaction to the extent of £500 on July 29th of debentures authorised October 17th, 1930, and registered October 17th, 1930. (According to the register of mortgages the debentures registered October 17th, 1930, originally secured £10,000.)

Rissik, Fraser & Co., Ltd. (formerly Rissik, Fraser, Spinks and Co., Ltd.).—C. O. Skey, of 10, St. Swithin's Lane, E.C., ceased to act as receiver and manager on July 31st.

Sandycroft, Ltd.—Issue on July 31st of £3,000 debentures, part of a series already registered.

Barker, Young & Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital and goodwill, dated July 30th, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Robert W. Blackwell & Co., Ltd.—Capital, £50,000 in £1 shares. Return dated December 9th, 1930 (filed January 29th, 1931). All shares taken up. £18,338 paid. £31,662 considered as paid. Mortgages and charges, nil.

Thompson, Ritchie & Co., Ltd.—Capital, £15,000 in 700 preference and 800 ordinary shares of £10 each. Return dated January 12th (filed April 15th, 1931). 700 preference and 190 ordinary shares taken up. £7,200 paid. £1,700 considered as paid. Mortgages and charges, £5,200.

Telsen Electric Co., Ltd.—Capital, £10,000 in £1 shares. Return dated December 31st, 1930 (filed June 4th, 1931). All shares taken up. £8,000 paid. £2,000 considered as paid. Mortgages and charges, nil.

William Simms & Co. (Felixstowe), Ltd.—Capital, £4,000 in £10 shares. Return dated June 12th, 1931. 203 shares taken up. £30 paid. £2,000 considered as paid. Mortgages and charges, nil.

E. P. Allam & Co., Ltd.—Capital, £6,000 in £1 shares. Return dated March 16th, 1931. 5,000 shares taken up. £2 paid. £4,998 considered as paid. Mortgages and charges, nil.

Monks & Byrne, Ltd.—Capital, £2,500 in £1 shares. Return dated April 20th, 1931. 2,000 shares taken up. £1,350 paid, £650 considered as paid. Mortgages and charges, nil.

Franklin & Freeman, Ltd.—Capital, £2,000 in £1 shares. Return dated January 14th (filed April 27th), 1931. 1,152 shares taken up. £1,152 paid. Mortgages and charges, nil.

Banting & Tresilian, Ltd.—Capital, £1,000 in £1 shares. Return dated April 24th, 1931. All shares taken up. £1,000 paid. Mortgages and charges, nil.

West Witton Electric Supply Co., Ltd.—Capital, £1,000 in £1 shares. Return dated February 21st, 1931. 885 shares taken up. £885 paid. Mortgages and charges, nil.

Permec, Ltd.—Capital, £100 in 1s. shares. Return dated November 23rd, 1930 (filed May 7th, 1931). All shares taken up. £100 paid. Mortgages and charges, nil.

Matthews & Yates, Ltd.—Capital, £22,050 in £50 shares. Return dated December 31st, 1930 (filed April 1st, 1931). 441 shares taken up. £6,000 paid, £16,050 considered as paid. Mortgages and charges: £20,000.

Clarke, Chapman & Co., Ltd.—Capital, £550,000 in 7,000 preference shares of £10 and 480,000 ordinary shares of £1 each. Return dated March 13th, 1931. 6,985 preference and 456,560 ordinary shares taken up. £100,210 paid, £426,200 considered as paid. Mortgages and charges, nil.

British Central Electrical Co., Ltd.—Particulars filed of debentures for sums not exceeding £1,000 at any one time, authorised July 30th, 1931, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £500.

F. W. Ames, Ltd.—Satisfaction in full on July 30th, 1931, of mortgage dated December 13th, 1923, and registered December 17th, 1923, securing £1,400.

Electro-Plant, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1930 (filed April 24th, 1931). Two shares taken up. £2 paid. Mortgages and charges, nil.

City Notes

Electrical Finance and Securities Co., Ltd.

Last week the directors offered to the ordinary shareholders of the company an issue of 50,000 7 per cent. cumulative preference shares of £1 each, at 21s. per share and 50,000 £1 ordinary shares at 30s. each. It was stipulated that equal amounts of preference and ordinary shares should be applied for, and that the basis of allotment was one new preference and one new ordinary share for each three ordinary shares held. The shares, when fully paid, will rank *pari passu* with the old shares of the two classes. The preference will thus receive a full half-year's dividend on November 1st and the new ordinary will participate in any distribution made in respect of 1931. The offer remains open until August 27th.

Companies to be Struck Off the Register

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Asgood Accumulator Co., Ltd.
Electric Hare Engineering Co., Ltd.
Excel Wireless Components, Ltd.
Fairfield Totalisator Syndicate Co., Ltd.
London Wholesale Electrical Supplies Co., Ltd.
Northern Electric Supplies Co., Ltd.
Radio Corporation of Portugal, Ltd.

Ruths Steam Storage, Ltd.—Shareholders have received a notice calling a meeting for September 15th to consider a resolution providing for alterations in the articles of association which are necessary to enable the scheme of reorganisation to be carried out. Subject to the Court's approval of the scheme, it is proposed to change the name of the company to "Ruths International Accumulators, Ltd." A petition for the reduction of the company's capital from £500,000 to £282,635 has been presented to the Court, and to remove an uncertainty raised by a question by the Court, it has been decided to re-submit the resolutions at the September 15th meeting.

The Canadian Hydro-electric Corporation, Ltd., had a net revenue available for dividends of $2,044,076 for the twelve months ended June 30th, or $16.35 a share on the first preferred stock, as compared with $1,484,446, or $11.88 a share, in the year ended June 30th, 1930. The output of electrical energy of the Corporation in the first six months of this year was 1,226,283,000 kWh, 1 per cent. greater than its output in the corresponding period of last year. For the twelve months ended June 30th, the output was 2,546,818,000 kWh, an increase of 9 per cent. over that for the preceding year.

Canadian Power and Paper Corporation.—The reorganisation plan of the Corporation was last week declared effective and Mr. L. J. Belknap, of Montreal and New York, was announced as president of the new company following a meeting of the Securities Protective Committee. A majority of all classes of securities had been deposited with the committee signifying approval by their owners of the reorganisation plan.—*Reuter* (Montreal).

Kiesselbach Steam Accumulators, Ltd., reports an adverse balance of £11,246 for the year ended March 31st last, raising the total debited to development and profit and loss account to £28,834. The directors state that the prevailing conditions have retarded development. Two additional Kiesselbach plants have been put into service and a third is expected to be completed towards the end of the current month.

The Middle West Utilities Co. and its subsidiaries report gross earnings of $44,264,832 for the quarter ended June 30th, as compared with $44,344,259 for the second quarter of 1930. The amount of net earnings accruing to the Middle West Utilities Co. was reduced from $7,371,601 to $6,744,468, owing to the interest payments on an issue of $50 million serial gold notes made in June last year. Of these $10,000,000 have now been redeemed.

London Nigerian Power Co.—A gross profit of £9,702 for the period January 17th, 1930, to February 28th, 1931, is recorded in the first report of the company. After providing for interest on debentures there remains £2,098, of which £1,885 is to be utilised to write off preliminary and debenture issue expenses, the balance of £213 being carried forward.

The Bognor Gas & Electricity Co. has declared interim dividends at the rate of 8 per cent. per annum on the ordinary and additional "A" consolidated stocks; at the rate of 9.2 per cent. per annum on the "B" consolidated stock; and at 7 per cent. per annum on the new consolidated stock. A similar distribution was made last year.

The Melbourne Electric Supply Co., Ltd., announces the payment of the dividend on the 8 per cent. first cumulative preference shares for the half-year ending August 31st. Payment is to be made in Melbourne, or (subject to deduction of Australian exchange and British income tax) at the company's London office, on and after September 1st.

Cables and Wireless, Ltd.—The directors state that the full dividend on the 5½ per cent. cumulative preference stock for the half-year to June 30th has not been earned. In the circumstances they have decided not to pay the dividend due on September 30th, but to await the financial result for the year ending December 31st next.

W. H. Dorman & Co., Ltd., report a net loss of £6,615 for the year ended March 31st last; there was a net profit of £5,381 in the preceding year. The adverse balance is thus increased to £47,244. The report mentions that economies have been effected to meet the decreased sales.

The Rhondda Tramways Co. earned a net profit of £687 in 1930 (against £5,323 in 1929), reducing the standing deficit to £3,100. Electricity is now being obtained from the South Wales Power Co.; it is stated that the assets of the Rhondda Tramways Electric Supply Co. by no means equal its liabilities.

The Clyde Valley Electrical Power Co. has declared an interim dividend of 3 per cent. actual, less tax (same) on its ordinary shares.

The New York Telephone Co. reports a gross revenue of $213,693,528, as compared with $199,642,411 in the preceding year. The net revenue increased from $55,072,870 to $59,047,644. The common stock dividend is maintained at 8 per cent., leaving a balance of $4,519,028.

The Adelaide Electric Supply Co., Ltd., has declared a half-year's dividend, payable September 1st, on the 6 per cent. cumulative preference shares. Warrants may be cashed in Adelaide, or (subject to the deduction of Australian exchange) in London.

The South Metropolitan Electric Light & Power Co., Ltd., announces the payment of the interim dividends on the 7 per cent. cumulative first preference shares and the 6 per cent. cumulative second preference shares.

The Canadian General Electric Co. has declared a quarterly dividend of $1 a share for the three months ending September 30th, being at the rate of 8 per cent. per annum.

Clarke, Chapman & Co., Ltd., announce an interim ordinary dividend of 2½ per cent., which compares with 3 per cent. paid last year.

The Mexico Tramways Co. is paying a half-year's interest on its general consolidated first mortgage 50-year 5 per cent. gold bonds.

The Newcastle-upon-Tyne Electric Supply Co., Ltd., is maintaining its interim ordinary dividend at 2½ per cent.

The Tokyo Electric Lighting Co. has declared a dividend of 2 per cent. (same) for the half year ended May 31st.

Waygood-Otis, Ltd., has raised its interim ordinary dividend from 2½ per cent. to 7½ per cent.

W. Canning & Co., Ltd., are again paying an interim dividend of 2½ per cent.

Stocks and Shares

TUESDAY EVENING.

The Economy Crisis

STOCK Exchange markets are overshadowed by the various factors which arise out of what may be called the economy crisis. From the fog of uncertainty, and out of the mist of mass-prediction, there emerges one clear fact: that is to say, the assurance of fresh taxes. The first three business days of this week are being devoted by the Government to final preparations for laying before the other parties, and the nation, definite plans whereby the anticipated Budget deficit of £120,000,000 shall be met. The Government has announced its intention of balancing the Budget at all costs. Statements from inspired quarters unmistakably imply that new sacrifices are to be called for on the part of those who hold fixed interest stocks and shares. Conversion, at present courteously called voluntary, of the 5 per cent. War Loan, is expected to be one of the sequelæ to the programme.

Effects upon Securities

The effect upon stocks and shares has been to bring down the prices of gilt-edged and fixed interest stocks and shares, and to cast a corresponding heaviness over most of the other investment descriptions. The argument is already beginning to take shape that if fixed interest stocks are to be singled out in this way for additional taxation, the effect will be to drive money out of such stocks and into the ordinary stocks and shares of what nowadays is called the equity class. As it is more than likely that the actual proposals of the Government will be laid before the country either before these notes are published, or on the same day that they appear, it would be superfluous to do more than glance in this cursory fashion at the factors whose influence has been responsible for most of the price-changes of the week.

Home Electricity Supply

The ordinary stocks and shares in the home electricity supply companies stand in a somewhat favoured position. In spite of the fact that after the end of this year the majority of shares in these companies will be put upon a level at which the standard dividend is to be 7 per cent., at any rate for the time being, it is considered practically certain that the companies will be able to make further share distributions from reserves. This, if undertaken generally, might raise the interest of the proprietors in their companies to an amount upon which the standard rate of dividend will produce about the same income as the holders are receiving now. A diminution of some kind is expected, and, taking the strictly austere view, the calculations in our tables in regard to the yield offered by the companies' shares are worked out on a 7 per cent. dividend basis. The ordinary shares in this group have, therefore, the advantage of being securities whose fixed dividend may give a higher return than is indicated in the figures, and, being ordinary shares, they would hardly be liable to inclusion in a group of investments that for taxation purposes will be regarded as having a fixed rate of dividend attached to them. Prices of the various shares are but little unchanged on the week. Neither in the London nor the provincial group is there much noticeable alteration. The Clyde Valley Electric Power Company has declared an interim dividend of 3 per cent., the same as that of a year ago. For the full year, the dividend was made up to 10 per cent. At the present price of the shares, 45s., the return is a shade under 4½ per cent. on the money. Scottish Power shares have gone back a little to 27s. 6d.

Home Railway Stocks

The General Council of the T.U.C. meets on the Thursday in this week in order to discuss the present position. Lively

interest centres upon what view the Trade Unions are likely to take. In advance, Home Railway stocks have been lowered as a precautionary measure. Metropolitan consolidated stock, at 36½, is a point down. Underground Electrics remain dull at 19s. 6d. The expectation that fixed interest stocks will be selected to bear the burden of fresh taxation has brought to market a fair amount of gilt-edged stock which, in the usual way, is difficult to obtain. Several of the debenture stocks have come in, and on Metropolitan District 4 per cent. guaranteed stock, to take one example, a yield of £5 1s. 6d. can be obtained from stock on offer in the market at 79. Metropolitan 3½ per cent. "A" preference can be bought at 65, and the company's 5 per cent. preference at 94, the average yield on the two being £5 7s. per cent. on the money. London Electric 4½ per cent. debenture at 82½, and Metropolitan District 4 per cent. prior lien debenture at 83½ are 1 and 2 points down, respectively. These five stocks are eligible for trustee investments.

Cables and Wireless

By a touch of grim financial irony, Cables & Wireless 5½ per cent. preference stock is one of those which will escape, at all events for this year, the incidence of taxation upon dividends, insomuch as no further distribution is to be made during the present twelve months. The price of the stock remains at 47½; the 7½ per cent. "A" ordinary has improved to 13. Globe Telegraph & Trust ordinary and preference have moved in contrary directions, the former being 10s. to the good, while the preference, at 8½, are 5s. lower. Marconi Marines keep at 30s. 9d. American Telephone & Telegraph is 5 points up at 180, and International Telephone & Telegraphs have risen 2 to 30. A slight weakening of Oriental Telephone shares has reduced the price to 43s. 9d.

Manufacturing Shares

The possibility of stocks and shares upon which variable dividends are paid being left untouched by the Chancellor of the Exchequer has failed to prevent a dull tendency in the market for the shares in the manufacturing and equipment companies. Callender's, for example, are 5s. down at 2½, and Henley's have fallen to 5. Enfield's are 1/16 lower at 3 15/16. British Aluminium weakened to 25s. 9d. These movements are due to sympathy with the general conditions that prevail throughout most of the markets of the Stock Exchange. It will be readily understood, of course, that in any holiday season there is not a great deal of support forthcoming for industrial shares of any kind, and this year the economic crisis has still further curtailed the ordinary volume of buying which takes place. Some embittered humorists go so far as to lay part of the blame for Stock Exchange depression upon the weather!

Dollar Stocks

The decision of Canada not to levy a special tax on dividends paid to non-resident shareholders, reference to which was made here last week, has given a mild stimulus to the shares of Canadian industrial companies. Shawinigan Water, at 43, have risen a point, and Montreal Light & Power, at 49½, have gained 2. Calgary Power shares remain unchanged at 145½, and Power Corporation of Canada, at 45, are ½ down.

Further falls have taken place in the Mexican group. The principal drop is one of 6 points in Mexican Light & Power 5 per cent. first mortgage bonds, the price of which has fallen to 64½. The 7 per cent. preferred shares, at 57½, are 3 lower, and Mexico Tramways 5 per cent. bonds, at 51½, show a fall of 3½ points. The weakness evidences the fear lest dividend and interest payments may be in jeopardy. Brazilian Tractions are a little easier. The tendency of American utility shares has been to slightly higher prices.

Tokyo Electric 6 per cent. bonds have come into demand, and the price has risen to 92, on the impression that Japan is one of the very few countries in the world which is paying its way and making progress. There is, moreover, a free market in the company's bonds, not only here, but in New York, although the two issues are not interchangeable. News from Geneva indicates that China is preparing an extensive industrial campaign, to be spread over the next ten years, in the course of which it is proposed that the country's industrial motor power shall be increased to 20 million h.p.

East African Light & Power £1 shares have declined to 25s., Delhi Electric Supply & Traction £1 shares to 27s. 6d. Atlas ordinary at 16s. and the preference at 24s. show small losses.

New Issues

Electric Finance & Securities, Limited, is offering 50,000 7 per cent. preference, and 50,000 ordinary shares, both of £1 each, at a guinea and 30s., respectively. One new preference and one new ordinary are offered for every three ordinary shares held, fractions being disregarded. Applications must be for equal numbers of preference and ordinary. Both classes of shares will rank *pari passu* with the existing shares when the new become fully paid. The price of the ordinary shares at the present time is 39s. 6d., and the preference stand at 23s. There is, accordingly, a useful bonus involved in the offer: dealings have started in the units on the basis of 10s. premium per unit. Each of these represents the relative "mixture" of ordinary and preference new shares. The new shares will be dealt in separately—as ordinary and preference, that is to say—towards the end of next week. The company's 5½ per cent. debenture stock is quoted at 101½.

Share List of Electrical Companies

Home Electricity Companies

	Nom.	Approx. Dividend 1929.	1930.	Price Aug. 18 1931.	Rise or fall.	Yield p.c.
Bournemouth and Poole	£ 1	15	15	58/9xd	—	5 2 0
Brompton Ordinary	1	8½	8½	28/6	—	4 18 3
Central Electricity 4½% Deb. ...	Stock	—	4½	96½	+½	4 13 0
Charing Cross Ordinary	1	8½	8½	30/6xd	—	4 11 10
Chelsea	1	8⅝	8⅝	28/-	—	5 0 0
City of London	1	10	10	37/-	—	5 8 1
Clyde Valley	1	8	8	32/6	—⅛	4 18 6
County of London	1	7	10	45/-	—	4 9 0
Edmundsons' 7% Pref.	1	7	7	26/-	—	5 7 8
Elec. Supply Corporation	1	11	12½	45/-	—	4 17 9
Kensington Ordinary	1	8	8	29/6	—	5 8 6
Lancs. Light and Power	1	7	6½	21/3	—	6 2 4
London & Home Counties 4½% Deb.	Stock	—	—	96½	—	4 13 3
London Electric	1	8½	9	34/-	—	5 5 11
Metropolitan	1	9	10	2⅝xd	—	4 18 9
Midland Counties	1	6½	7	27/6	—	5 1 10
Mid. Elec. Power	1	15	8	28/3	—	5 13 3
Newcastle-on-Tyne Ordinary ...	1	6	6	22/-	—	5 9 1
do. 7% Pref.	1	7	7	27/6	—	5 1 10
Notting Hill 6% Pref.	10	6	6	11½	—	5 6 8
North Met. Elec. 6% Pref.... ...	1	6	6	24/-	—	5 0 0
St. James' and Pall Mall	1	8	8	29/6	—	4 14 1
Scottish Power	1	8	8	27/6	—9d.	5 16 3
South London	1	8½	8½	27/6	—	5 1 10
Urban Ordinary	1	7	7	28/3	—	4 19 1
Westminster Ordinary	1	9½	8½	29/6xd	—	4 15 0
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	25/3	—	5 18 10
Yorkshire Elec.	1	8	8	30/9	—	5 4 1

Home Rails

Central London Ord. Assented ...	Stock	4	4	77	—	5 3 6
Metropolitan	,,	4	3½	56½xd	—1	9 11 9
do. District	,,	5	5	60½	—	8 5 4
Underground Electric	£1	8	8	19/6	—	8 4 2

Telegraphs and Telephones

Anglo-Am. Tel. Pref....	Stock	6	6	103	—	5 17 8
do. Def-	,,	1½	1½	35	—	6 0 0
Cables & Wireless 5½% Pref. ...	Stock	5½	5½	47½	—	... ...
do. A 7½% Ord.	,,	Nil	—	13	+1	... ...
do. B Ord.	,,	Nil	—	6½	—	... ...
Globe Tel. and T. Ord.	10	10	8½	5½	+½	... ...
do. do. Pref.	10	6	6	8½	—¼	7 1 2
Great Northern Tel.	10	20	20	25	—	8 0 0
Marconi-Marine	1	15	15	30/9	—	9 15 2
Oriental Telephone Ord.	1	12	12	2⅞	—⅛	*5 9 6

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	—	10/-	—	... ...
do. do. 2nd Pref. ...	5	6	—	7/6	—	... ...
do. do. 5% Deb. ...	Stock	5	5	18	—	.. ...
British Electric Traction Def. Ord.	,,	5	5	775	—25	... ...
do. do. Pref. Ord. ...	,,	8	8	124½	—	6 8 9
Brazil Traction	100	8	—	18	—¼	... ...
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	96½	—	5 3 3
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	63½	—	6 7 0
Mexico Trams, 5% Bonds	—	5	5	31½	—3½	15 17 6
Mexican Light Common	100	Nil	Nil	25	—	... ...
do. 7% Pref.	100	7	7	57½	—3	11 11 6
do. 1st Bonds	—	5	5	64½	—6	7 15 0
Victoria Falls Ord.	1	15	15	57/6	—	5 4 4
Yorkshire (West Riding)	1	Nil	Nil	6/3	—	... ...

Manufacturing Companies

Assoc. Elec. Ord.	1	6	6	20/-	—	6 0 0
do. Pref.	1	8	8	28/3	—	5 12 3
Babcock & Wilcox	1	15	14	43/-	—	*6 10 2
British Aluminium Ord.	1	10	10	25/9	—⅛	7 15 2
British Insulated Ord.	1	15	15	22½	—	5 9 1
Brush Ord.	Stock	10	5	60	—	8 6 0
Callenders	1	15	15	9½	—¼	6 0 0
do. 6½% Pref....	1	6½	6½	26/3	—	4 19 1
Crompton Parkinson Ord.	5/-	20	20	1	—	7 10 0
do. 8% Pref.	1	8	8	28/3	—	5 13 3
Edison-Swan 1st Pref.	1	7½	7½	23/3	—	6 9 0
do. 5% Deb	Stock	5	5	92½	—	5 8 1
Electric Construction ...	1	5	Nil	10/-	—	... ...
Enfield Cable Ord.	1	25	25	3¹⅞₁₆	—1/16	6 7 0
English Electric	1	Nil	Nil	5/-	—	... ...
do. do. Pref.	1	Nil	Nil	5/-	—	... ...
Ferranti Pref.	1	7	7	20/3	—3d.	6 18 3
G.E.C. Pref.	1	6½	6½	26/6	—	5 2 0
do. Ord.	1	14	10	2	—	5 0 0
Henley	1	30	30	5	—⅜	6 0 0
do. 4½% Pref.	5	4½	4½	4¾	—	5 2 10
India-Rubber	1	Nil	Nil	4/6	—	... ...
Johnson & Phillips	1	10	10	28/9	—	6 19 2
Siemens Ord.	1	7½	7½	29/9	—	7 4 7
Telegraph Construction	12	10	7½	10	—	9 0 8

*Dividends paid free of Income Tax.

Our Foreign Electrical Trade

Imports and Exports during July

THE Board of Trade returns of this country's imports and exports during July show that in both directions —outward and inward—trade made an advance on the preceding month's volume; this was particularly marked in the case of exports of United Kingdom goods which increased by 16 per cent., against a rise of just over 2 per cent. in imports. The improvement in exports was thus a substantial one and not merely due to the fact that the month was a day longer than June.

Reference to the electrical trade figures, which we summarise in our usual monthly table, shows that both imports and exports increased as compared with June—imports by 11¼ per cent. and exports by 17 per cent. It will be noted that while electrical exports rose in about the same proportion as exports in general, electrical imports made a much greater advance than general imports.

The July exports were "inflated" to some extent by the rise of £55,683 in submarine cable shipments; this, as is well known, is an item which is liable to the most violent fluctuations, owing to rather infrequent shipments of considerable value. The advance upon the June trade was general but batteries and accumulators, in particular, made a big upward move. The machinery section showed improvement and there were fairly substantial rises in the other two cable classes. Only telegraph and telephone apparatus and arc lamps failed to participate in the all-round increase.

Comparing the figures with those for July, 1930, however, reveals a very substantial decline which was not materially altered by the rise of £49,386 shown for submarine cables. The machinery section was the most seriously affected, the total fall in this section amounting to £254,306. The value of the exports of insulated wires and cables was less than half of that of the July, 1930, shipments, and non-submarine telegraph and telephone wires and cables were almost as badly affected. Another item which declined considerably was telegraph and telephone apparatus which was over £98,000 down.

Our inset tables shows that the decline in electrical machinery exports was common to all markets. Japan's purchases, which have long been declining, were apparently less than one ton of the value of only £220, as against 78 tons (value £14,483) in July, 1930. Australia's share also continued its rapid downward movement and what used to be one of our leading markets is becoming one of the smallest. New Zealand, mainly no doubt on account of the economy measures which are being adopted by the Dominion Government, only took about a third of the quantity which was purchased in the corresponding month of last year. The greatest actual decline, however, occurred in the case of India, formerly our most important market for electrical machinery. It is rather strange to see this position now occupied by Europe as a whole, although in this case, too, there was a decline of about a third in the value of shipments. It is again noted that although prices have fallen during the past year, the value per ton of exported electrical machinery rose from about £155 in July, 1930, to £168 last month. It is possible that this accounts to some extent for the diminution of exports. At the same time imported electrical machinery, which is on the whole of a lighter character than that which we export, rose in value from £320 to £376 per ton. This increase, however, does not appear to have had such an effect on imports as (perhaps) the increase in the price of British machinery has had on exports. The figures may not be strictly comparable month by month, as there is tremendous scope for variation.

Electrical Machinery Exports

Destination.	Quantities. July, '30. Tons.	Quantities. July, '31. Tons.	Quantities. Decrease. Tons.	Values. July, '30. £	Values. July, '31. £	Values. Decrease. £
Europe	597	313	284	112,336	81,490	30,846
Japan	78	—	78	14,483	222	14,261
South America	301	199	102	50,042	33,793	16,249
South Africa	220	162	58	31,795	29,655	2,140
British India	789	271	518	114,997	43,280	71,717
Australia	447	67	380	66,952	11,728	55,224
New Zealand	88	29	59	14,954	5,874	9,080
Canada	216	122	94	28,653	15,182	13,471
Other countries	1,015	792	223	149,001	107,683	41,318
Totals	3,751	1,955	1,796	£583,213	£328,907	£254,306

Reverting to the past month's imports, it will be noticed that the increase as compared with June was practically general, there having been only two small decreases. The greatest rise among the specified classes occurred in the case of telegraph and telephone apparatus; batteries and accumulators also showed a substantial increase. In the comparison with July, 1930, telegraph and telephone apparatus also stands out with an increase of £48,547. The only other large advance was made by unenumerated goods and apparatus. There were three large decreases in the list: meters and instruments declined by about 80 per cent.; glow lamps by about 45 per cent.; and insulated wires and cables by about 26 per cent.

The re-exports were £32,919 down on the July, 1930, figures, principally on account of a fall of over £15,000 in telegraph and telephone apparatus.

The statistics for the first seven months of the year show that electrical exports have declined by 33 per cent., as compared with the corresponding period of last year, and imports by 26 per cent.

	Exports. Electrical exports for July, 1931.	Exports. Inc. or dec. as compared with June, 1931.	Exports. Inc. or dec. as compared with July, 1930.	Imports. Electrical imports for July, 1931.	Imports. Inc. or dec. as compared with June, 1931.	Imports. Inc. or dec. as compared with July, 1930.	Re-Exports. Electrical re-exports for July, 1931.	Re-Exports. Inc. or dec. as compared with June, 1931.	Re-Exports. Inc. or dec. as compared with July, 1930.
Electrical goods and apparatus (unenumerated)	£164,142	+ £17,845	— £79,460	£149,026	+ £19,412	+ £32,730	£6,377	+ £357	— £3,524
Insulated cables and wires ...	108,844	+ 11,228	— 150,390	67,267	+ 3,261	— 23,926	288	— 740	— 952
Glow lamps	37,999	+ 4,102	— 44,349	39,462	+ 7,985	— 32,975	237	— 121	— 212
Arc lamps and parts	252	— 577	— 600	4,156	— 1,341	+ 3,044	90	+ 6	— 463
Batteries and accumulators ...	75,368	+ 33,215	+ 12,199	47,356	+ 11,937	+ 7,432	1,480	— 60	+ 1,322
Meters and instruments ...	27,387	+ 4,538	— 1,765	23,248	+ 230	— 78,303	439	— 325	— 8,181
Carbons	1,304	+ 762	— 973	15,721	+ 3,089	+ 951	698	+ 492	+ 36
Switchboards (not telegraph or telephone)	7,383	+ 5,936	— 1,125	—	— 165	— 52	78	+ 78	+ 78
Electrical Machinery—									
Electrical machinery (unenumerated)	180,272	+ 5,946	— 162,686	134,096	+ 2,156	— 6,924	7,834	— 2,920	— 5,612
Railway and tramway motors	7,144	+ 2,952	— 2,233	—	—	—	—	—	—
Other motors and generators...	111,491	+ 11,237	— 89,387	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cables (not submarine)	33,609	+ 10,409	— 33,150	2,674	+ 1,288	+ 1,355	37	— 34	+ 37
Submarine telegraph and telephone cable	56,032	+ 55,683	+ 49,386	—	—	—	—	—	—
Telegraph and telephone apparatus	179,004	— 12,632	— 98,393	110,521	+ 14,051	+ 48,547	6,343	— 205	— 15,448
Total	£1,020,231	+ £150,644	— £602,926	£593,533	+ £61,953	— £18,121	£23,901	— £3,472	— £32,919
Decrease for first seven months of the year		Exports £3,623,148			Imports £1,355,201			Re-Exports £170,698	

Rumanian Electrical Trade Prospects

MR. R. J. E. HUMPHREYS, Commercial Secretary to the British Legation, Bucharest, has transmitted to the Department of Overseas Trade a report on economic conditions in Rumania, dated May, 1931 (Stationery Office, 2s. 6d. net). As a preface to the report there are a useful Commercial Summary and some "Hints for Commercial Visitors." Rumania has a population of about 18 millions. In 1929 trade between this country and Rumania showed a balance of about £650,000 in the latter's favour, but in the succeeding year this balance rose to £2,780,000.

The introduction to the report briefly reviews economic conditions during the past ten years. In 1929 the leu was stabilised at 813.59 to the £, and it was hoped that the bottom of economic depression had been reached. Subsequently, however, the prices of Rumania's staple products continued to fall, and in spite of a good harvest Rumania was forced to restrict her imports. This led to a reduction of 20 per cent. in Customs receipts and a corresponding fall in railway traffics, raising the prospect of a very large budgetary deficit.

Import Trade

The report does not give detailed figures of Rumanian import trade but notes are made on a number of the leading classes of goods imported during the first half of 1930. It is stated that industrial machinery was mostly supplied by Germany; small lots came from Austria and other countries, including the United States, which supplied mainly oil machinery. Imports of internal-combustion engines were divided between the United Kingdom, Austria, Germany, and Switzerland, the last-named country being responsible for the larger sizes. Germany heads the list of suppliers of most kinds of electrical machinery and goods generally. Certain quantities came from Switzerland, Austria, &c. Mr. Humphreys avers that United Kingdom manufacturers have hitherto completely neglected this market, the importance of which is shown by the fact that the following firms have established their own offices in Bucharest: The A.E.G., Siemens-Schuckertwerke, Brown-Boveri, the A.S.E.A., Ericsson's, and the French Thomson-Houston Co. The Tungsram, Osram, Philips, and other lamp concerns also have their own offices in Bucharest. United States electrical manufacturers have lately begun to pay more attention to the market. Caution is advised when dealing with local traders, and special care should be taken in the appointment of agents.

Broadcasting and the Radio Market

The number of broadcasting "listeners" has increased very rapidly. At the end of 1929 the total was 29,746; six months later the number had grown to 43,254. The increase is attributed almost wholly to the removal of practically all restrictions on the importation and use of radio apparatus. The State takes 30 per cent. of the receipts, the balance going to the broadcasting company, which also derives revenue from advertising. The company intends to build two additional stations, but so far no funds are available.

Most of the radio apparatus and accessories sold in Rumania are of German origin. Some American, Dutch, Austrian, British, French, and other apparatus, including loud-speakers, are also well introduced. British manufacturers would be well advised to pay more attention to this market in view of future trade, although the present conditions are depressing.

Electrical Manufacture in Rumania

Mr. Humphreys says that no great expansion has taken place in electro-technical works. Dry batteries are produced in sufficient quantities to meet the home requirements. The producing capacity of Rumanian manufacturers of accumulators is also sufficient to meet the needs of the market, but considerable quantities are still imported, especially from the United States, as they are cheaper and of better quality than those of home manufacture. Considerable quantities of electric irons, kettles, lamps, Bergmann tubes and some insulated wire are also produced in Rumania, but the imports from abroad are still important. The electric lamp factory, which was purchased by a German trust, has not been working since 1928. Electrical machinery is produced only by two firms, "Energia" and "Resita," which manufacture fair quantities of motors, dynamos, transformers, alternators, &c.

Power Production

According to figures published by the Ministry of Industry and Commerce the capacity of power plant in Rumania at the end of 1929 totalled 1,183,886 h.p., of which 483,261 h.p. was accounted for by steam plant and 412,864 h.p. by oil engines. The capacity of electric power plant was given as 321,227 kW, of which 225,930 kW was a.c. The aggregate power of electric motors in use was stated to be 178,915 h.p. The annual power consumption is put at 58,527 milliard kWh.

During 1930 negotiations were on foot with various foreign financial and technical groups with a view to the promotion of extensive electrification works in the country, both for railways and other purposes; but for some reason unknown these negotiations have never been satisfactorily concluded. Very little use has been made of water power in Rumania. A special law governs its exploitation, which is in the hands of the State. The total water power reserves are said to be over six million h.p.

The Telephone Concession

A concession for a minimum of 20 years of the whole public telephone system of Rumania has been granted to the International Telephone and Telegraph Corporation of New York; the contract was ratified on July 3rd, 1930. For the purposes of this concession a Rumanian company was formed, in accordance with the provisions of the contract, called the Societatea Anonima de Telefoane. All the existing premises, material, and installations for the telephone service were purchased and taken over by this company on January 1st, 1931. The telephone systems of the Ministry of the Army, General Staff, Ministry of the Interior, police force, and the railways are not included in this contract. The company has undertaken to introduce an automatic telephone system in various towns within five years. The Government has the right to repurchase the whole public telephone system after 20 years, if the company is notified two years in advance. Since the new company took over the telephone system, connections have been established between Bucharest and Vienna, Prague, Paris, and other European cities, while internal communication has been improved.

Indian Electrical Notes

(From Our Own Correspondent.)

Madras Government Policy

THE Government of Madras has passed orders on the question of the royalties to be charged for the diversion or use of water from Government sources for the generation of electricity. It has been decided that the rates prescribed on the standard form of licence already approved by Government, should continue, but that they will not necessarily be adopted in cases where Government hydro-electric projects will not be affected by private installation. It will be prepared, however, to consider the grant of more favourable terms in such cases if it desires to encourage hydro-electric development by private enterprise. In areas where the Government can supply hydro-electric power, or expects to be able to do so at an early date, no licence for new installations will be granted.

Irwin Power Station

A new power house known as the Irwin power station has been constructed in Gwalior. The site is adjacent to the Tigra canal from which the supply of circulating cooling water is taken. Three boilers have been erected and provision for a fourth is made. The grates are of the mechanical stoker type, each electrically driven through a four-speed gear box. The turbo-alternator sets are of the "Metrovick" self-contained type. For the erection and equipment of the new power station, and also for the equipment of the pumping station, the Metropolitan-Vickers Electrical Co., Ltd., acted as main contractor.

Extension of Electricity

Extension of electric power is going on apace in Madras Presidency and the Mysore territory. The Dewan of Mysore recently announced that extensions of electric power had been completed in four towns in the district of Kolar, and that villagers within a radius of twelve miles of these towns were taking power for agricultural purposes. Chikkalpur and Nandydroog will soon be electrified, and proposals for supplying power to other towns are under active consideration. On the Madras side, the town of Kumbhakonam has laid the foundation of a power house, and a supply will be available by January next.

Wireless Licences

Under the regulations recently issued by the Director-General of Posts and Telegraphs, licences for the demonstration of radio receiving apparatus, the installation of such apparatus for approval at the addresses of prospective customers, and the hiring out of radio sets, will be granted to *bonâ-fide* dealers, one licence covering the erection and working of one set only. It will ordinarily be available for use throughout one province (excepting Indian States and foreign territories). A sufficient number of licences must be taken out to cover the maximum number of sets to be used at one time. The duration is twelve months and the fee is Rs.10 per licence. The application has to be made direct to the Director-General.

The Import Duty

In a speech to the Calcutta Rotary Club, Mr. P. I. Keith Murray said that, so far as the import duty was concerned, it was found that quite a large proportion of wireless goods brought into India were charged at a higher rate of duty and classed as electrical goods. In a very large number of cases the goods could only be used for radio, but where there was the slightest chance of their being put to other uses the Government quite naturally charged the higher rate. For instance, accumulators, aerial wire, loud-speakers, combined gramophones and receiving sets, amplifiers, &c., were brought in under electrical and musical duties, which ran as high as 40 per cent. None of this was credited to broadcasting. If it were it might show a reduction in the loss in broadcasting.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Hire-purchase

I have read the letter from "Interested" which appeared in your issue of August 7th.

I do not think it desirable to enter into a lengthy correspondence on the subject, as I replied fully in my letter of the 15th ultimo to the points raised by your correspondent, but I should like to refer to one sentence in his letter where he says, "If as is stated, such careful inquiries are made as to the standing of the purchaser, why should the contractor still have to take all the risk?"

I think your correspondent has overlooked the very important fact that banking and electrical contracting are two widely different businesses, both better left to the specialist.

United Dominions Trust (Electric), Ltd., is a banking house and its function is to grant facilities to enable electrical manufacturers and contractors to extend long-term credit to their customers. If it were to take upon itself functions that are purely those of the contractor, then it might well go a step further, open an electrical contracting department and do the whole of the work.

Furthermore, it is essential in the contractors' own interests that they should retain control of each transaction until its ultimate completion and this is not possible if the financial house exceeds its proper function—that of providing money and service.

UNITED DOMINIONS TRUST (ELECTRIC), LTD.
J. Gibson Jarvie,
London, E.C.2, *August 13th*, 1931. *Chairman.*

The Marking of Slip Rings

We note with interest the letter in your correspondence columns of August 14th from Mr. J. H. Walker, *re* the marking of slip rings. As we have constructed a number of machines of the type to which he refers, our views on the subject may be of assistance to him.

In a slip-ring type alternator the a.c. output through the rings is in synchronism with the rotation of the machine. The current passing from brush to ring, or *vice versa*, reaches peak value at a definite point, or points, in each revolution. There is, therefore, a point, or series of points, on each ring where the current density under the brush face considerably exceeds the mean or r.m.s. value. If this peak density is high the rings will be marked at each point, and excessive wear will eventually take place in the overloaded region. This defect is particularly likely to occur in small slip-ring alternators of the type described, constructed presumably in direct current machine frames with minor modifications to brush gear, &c.

The difficulty can be overcome by careful consideration as to brush size and grade and particularly to brush spacing, the latter being most important. In our experience alternators of this type should be provided with brush gear designed specially to suit the machine.

It is difficult to explain the exact spacing of the marks on the rings of Mr. Walker's alternators in the absence of data as to the number of brush arms, spacing and arrangement of brushes, and number of alternator poles. The position of the marks is also dependent on the power factor of the output and is further complicated by the fact that at some points the current always flows from brush to ring, and at others from ring to brush. This has a considerable bearing on the degree of wear and marking, particularly at high current densities.

We trust our explanation is clear enough to be of some assistance to your correspondent.

BULL MOTORS, LTD.
F. H. Johnson, *Director.*
Ipswich, August 14th, 1931.

Installation Work in a Shipyard

While visiting a shipyard, I noticed that three 7/.044 "Brumite" covered cables, carrying a 3-phase, 200-cycle, 125-volt supply for high-frequency portable drilling machines, and two 7/.064 similar cables used for lighting purposes (between phase and neutral) carrying current at 50 cycles, 110 volts, were installed in the same conduit.

The 200-cycle supply was derived from a 25-kVA frequency changer and the 50-cycle supply from a 50-kVA transformer.

The conduit was 500 ft. in total length; it had c.i. tee boxes fitted at each hundred feet, and was laid in dark ashes at a depth of six inches under the surface. The track of the conduit was parallel to the berth on which ships are built, and had an inclination of ¼-inch to each foot. Some 150 ft. of the lower end of the track of the conduit was below sea-water level at each high tide. From the c.i. tee boxes conduit was carried upwards, supported by iron uprights, to a height of eight feet above ground level. On the iron uprights were fitted the necessary ironclad plugs, switches, fuses, &c., to facilitate connection to the portable drills and lighting.

I understand that it is proposed to install eight similar "runs" of conduit, one "run" for each berth in the shipyard.

I shall be glad to have your readers' comments on an installation of this description.

August 16th, 1931. ELECTRICIAN.

Book Reviews

Quantity and Economy in Manufacture. By FAIRFIELD E. RAYMOND. Pp. xiii+375; figs. 45. London: McGraw-Hill Publishing Co., Ltd. Price 20s. net.

The study of economic lot sizes is one of absorbing interest and is, in fact, indispensable for the effective operation of a manufacturing plant. The author has divided this book into three sections. The first is intended primarily to demonstrate the importance of a more scientific approach to the carrying out of all manufacturing operations and the utility of economic production quantities. The second and third parts of the book are devoted to a thorough analysis of all factors which may contribute to a better understanding and more general acceptance of the basic principles.

Patent Law. By F. H. RHODES. Pp. x+207. London: McGraw-Hill Publishing Co., Ltd. Price 12s. 6d. net.

This book on American patent law is intended primarily to assist chemists, engineers, business men, and others to whom the subject is interesting and important because of its relationship to their business and professional activities. In arranging the subject matter most of the emphasis has been placed upon the discussion of the nature and scope of patents and the extent of the protection afforded by them, comparatively little space being devoted to the consideration of formal matters of procedure to be followed in obtaining patents or in prosecuting patent actions, since these are almost always handled by attorneys with specialised training in patent law.

Siebschaltungen (Filter Circuits). By DR. ING. W. CAUER. 24 pages of text with 19 illustrations, 14 schedules, and 68 charts, in loose-leaf form. Berlin: V.D.I.-Verlag. Price Rm.14.

Since the discovery that certain "chain-circuits" can be made to reject or to accept certain bands of frequencies, their ever-increasing field of application has induced engineers to endeavour in numerous monographs to contribute to the advancement of the theory and design of filter circuits. While we owe to them a number of valuable suggestions, a unified general theory applicable to the great variety of possible filter circuits has been lacking. The most important feature of the theory developed in this treatise is that it is not based on special circuits, but on certain functions of the frequency, which, independently of the individual constructive features of the circuits, permits of their precise characterisation. Thus the technical problem is reduced to mere algebraic terms involving the theory of mathematical functions, interpolation is solved according to the Tshebysheff method. The book has been written chiefly for the designer of filter circuits. Theoretical discussions have therefore been restricted and the many tables and charts assist the solution of problems with the smallest expenditure of thought and calculation, and at the same time economically (*i.e.*, involving the smallest possible number of coils and condensers). The loose-leaf form of the publication has been chosen with regard to the requirements of engineers, as it permits of the independent use of each of the curve sheets and tables. The work is useful also for those who wish to acquaint themselves with modern theory without having the time to follow intricate mathematical deductions.

Experimental Radio Engineering. By JOHN H. MORECROFT, E.E., D.Sc. Pp. 345; figs. 250. London: Chapman and Hall, Ltd. Price 17s. 6d.

Many excellent books on radio engineering by American authors lose much when they travel across the Atlantic, due to the fact that they are mainly concerned with American practice. In this respect Dr. Morecroft's books do not suffer to any great extent, as they always deal, in the main, with principles in a full clear manner, a point which is appreciated here just as much as it is on the other side. "Experimental Radio Engineering" strikes out a new line, and has the advantage, from the point of view of the British reader, of being concerned only with the fundamental principles which lie at the root of all practice. To quote from the preface:—"Someone has the task, therefore, of dissecting into its simple constituents, receiving and transmitting apparatus, and laying out such tests as shall bring out the characteristics of these component parts." In all, 51 experiments are described, but this number is really misleading as the subjects are so fully considered that these experiments cover almost the whole field of radio reception and the most important aspects of radio transmission. The book is indeed a comprehensive guide to laboratory work to be carried out in parallel with the work of the class-room. There is no other so far as we are aware, which attempts to cover similar ground, and no doubt it will prove of great value on the practical side in courses of instruction for radio engineers.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1930

1,342. "Transformer coupling systems for wireless signalling." Hazeltine Corporation. February 15th, 1929. (353,447.)

5,155. "Lightning and surge absorbers." Ferranti, Ltd., and J. L. Miller. February 15th, 1930. (353,460.)

5,818. "Electric switchgear." A. Reyrolle & Co., Ltd., and J. Christie. February 21st, 1930. (353,408.)

5,846. "Electromagnetic interrupters employed as rectifiers for electric measuring purposes." Siemens & Halske Akt.-Ges. May 28th, 1929. (353,462.)

5,961. "Method of detecting changes in electric capacity." W. W. Triggs (Theremin Patents Corporation). February 22nd, 1930. (353,481.)

5,962. "Measuring variations of frequency of oscillating electric systems." W. W. Triggs (Theremin Patents Corporation). February 22nd, 1930. (353,482.)

6,075. "Metal-clad electric switchgear." A. Reyrolle & Co., Ltd., and J. Christie. February 24th, 1930. (353,463.)

6,411. "Measurement of electrical energy." Ferranti, Ltd., and W. Holmes. February 26th, 1930. (353,485.)

9,503. "Asynchronous electric cascade generator." Forges and Ateliers de Constructions Electriques de Jeumont. April 16th, 1929. (Patent of addition not granted.) (353,489.)

9,565. "Wave signalling systems." J. Robinson. March 25th, 1930. (353,490.)

9,598. "Electric switchgear." A. Reyrolle & Co., Ltd., and J. Christie. March 26th, 1930. (353,491.)

11,601. "Radio beacon and printing apparatus." Sleeper Research Laboratories Inc. January 14th, 1930. (353,414.)

11,929. "Sound-recording and sound-reproducing apparatus." British Thomson-Houston Co., Ltd. April 19th, 1929. (353,417.)

11,939. "Electric measuring apparatus." A. E. Young. February 4th, 1930. (353,418.)

12,075. "Wireless circuits." C. S. Agate and J. E. Rhys-Jones. April 16th, 1930. (Cognate application 26,101/30.) (353,419.)

12,098. "Current transformer." R. H. Borkent. June 25th, 1929. (353,420.)

12,192. "Telephone instrument circuits." Standard Telephones & Cables, Ltd., and A. Lee. April 17th, 1930. (353,421.)

12,454. "Single-phase commutator dynamo-electric machines." Osterreichische Siemens-Schuckertwerke, A. Grabner, and R. Stix. April 22nd, 1930. (353,469.)

12,488. "Discharge relay and amplifying circuits or arrangements for amplifying or recording wireless signals or for other purposes." W. B. Mackenzie, H. Smith, and E. G. Hill. April 22nd, 1930. (353,438.)

12,605. "Train-control systems." Associated Telephone and Telegraph Co. and A. E. Hudd. April 23rd, 1930. (Cognate applications 30,189/30 and 33,309/30.) (Addition to 5,680/31.) (353,502.)

12,676. "Television and other electro-optical systems for reproducing pictures and the like at a distance." Electrical Research Products Inc. May 25th, 1929. (353,471.)

12,677. "Methods of manufacturing loaded electrical conductors." Electrical Research Products Inc. June 6th, 1929. (353,472.)

12,713. "Directional wave-transmission." C. Lorenz Akt.-Ges. June 6th, 1929. (353,476.)

12,796. "Telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. April 25th, 1930. (353,508.)

12,833. "Synchronising in signalling circuits." Standard Telephones & Cables, Ltd., and E. K. Sandeman. April 25th, 1930. (353,514.)

12,834. "Telegraph systems." Standard Telephones and Cables, Ltd., E. K. Sandeman, and L. E. Currah. April 25th, 1930. (353,515.)

12,835. "Systems for communicating with moving vehicles." Standard Telephones & Cables, Ltd. October 2nd, 1929. (353,516.)

12,836. "Antenna systems." Standard Telephones & Cables, Ltd. October 11th, 1929. (353,517.)

12,850. "Insulating-compositions." Electrical Research Products Inc. January 18th, 1930. (353,518.)

12,851. "Electrical insulating materials containing guttapercha or balata." Electrical Research Products Inc. February 3rd, 1930. (353,519.)

12,863. "Thermo-electric batteries." J. Neale. April 25th, 1930. (353,521.)

13,334. "Wave meter for short electromagnetic waves." Standard Telephones & Cables, Ltd. (A. G. Clavier and H. R. Darbord). April 30th, 1930. (353,533.)

13,335. "Electrical measuring instruments." Standard Telephones & Cables, Ltd., and H. R. Stocks. April 30th, 1930. (353,534.)

13,374. "Electric regulating systems for dynamo-electric machines." Electrical Research Products Inc. April 30th, 1929. (353,541.)

13,459. "Brush gear for dynamo-electric machines." E. R. and F. Turner, Ltd., and F. H. Johnson. May 1st, 1930. (353,544.)

13,792. "Electric cables." W. T. Henley's Telegraph Works Co., Ltd., and W. W. Watkins. May 5th, 1930. (353,548.)

13,906. "Photo-electric cells." Westinghouse Lamp Co. May 6th, 1929. (353,554.)

13,907. "Photo-electric cells." Westinghouse Lamp Co. May 6th, 1929. (353,555.)

14,160. "Winding for dynamo-electric machines." R. E. Muller. May 8th, 1929. (353,558.)

14,186. "Alternating-current electrical instruments and electro-magnets therefor." Aron Electricity Meter, Ltd., E. W. Hill, A. White, and E. J. Riordan. May 8th, 1930. (353,561.)

14,192. "Maximum demand indicators." Aron Electricity Meter, Ltd., and E. W. Hill. May 8th, 1930. (353,562.)

14,309. "Electrical heating apparatus." Aktieselskapet Elektrisk Bureau. May 10th, 1929. (353,563.)

14,581. "Winding arrangement for dynamo-electric machines." Siemens-Schuckertwerke Akt.-Ges. May 30th, 1929. (353,569.)

14,844. "Indicating scales and indexes of electrical apparatus." A. F. M. Hicks. May 14th, 1930. (353,572.)

14,953. "Electric cranes." Craven Bros. (Manchester), Ltd., and S. H. Stott. May 15th, 1930. (353,575.)

14,986. "Speed-controlling mechanism." British Thomson-Houston Co., Ltd., and R. D. Given. May 15th, 1930. (353,576.)

15,620. "Electro-magnetic clutches." H. E. Hodgson. August 2nd, 1929. (353,590.)

15,692. "Systems for indicating or repeating the movement of a member electrically." T. R. Warren and Associated Electrical Industries, Ltd. May 21st, 1930. (353,591.)

16,479/80. "High-tension air-break electric switches." Associated Electrical Industries, Ltd. May 29th, 1929. (353,602/3.)

17,099. "Boxes for containing electrical devices or accessories." H. A. Wootton (trading as H. A. Wootton & Co.). June 4th, 1930. (353,614.)

17,717. "Method for producing multiple electron-discharge devices." Dr. S. Loewe. June 7th, 1929. (353,624.)

17,976. "Burglar and like alarms employing thermionic oscillations." E. M. F. Fromy. June 11th, 1930. (Addition to 5,982/30.) (353,627.)

18,083. "Transmitting system for simultaneous low-frequency and carrier-frequency telephony." Simens & Halske Akt.-Ges. June 26th, 1929. (353,629.)

18,103. "Transmission systems for carrier-current telephony." Siemens & Halske Akt.-Ges. July 26th, 1929. (353,630.)

18,183. "Methods of making electric insulators." International General Electric Co. Inc. June 13th, 1929. (Addition to 350,429.) (353,632.)

19,100. "Bases for electric switches or the like." General Electric Co., Ltd., and H. L. Bentley. June 23rd, 1930. (353,646.)

19,376. "Electro-magnetic loud-speakers." W. Schongs. November 12th, 1929. (353,651.)

20,091. "Thermionic amplifiers employing five-electrode valves." Gramophone Co., Ltd., H. C. Atkins, and H. C. Huxter. July 2nd, 1930. (353,658.)

20,297. "Connector or sleeve for electric cables." H. A. Dunn. July 4th, 1930. (353,660.)

21,255. "Photo-electric cell circuits." Edibell Sound Film Apparatus, Ltd., and W. M. Betts. July 14th, 1930. (353,672.)

22,039. "Electro-magnetic relays." Y. M-L de Paniagua. July 22nd, 1929. (353,689.)

22,054 "Systems for relaying and distributing radio programmes." P. P. Eckersley and J. W. C. Robinson. July 22nd, 1930. (Cognate application 920/31.) (353,690.)

22,500. "Reproduction of sound from sound-film records." General Electric Co., Ltd., and W. H. Peters. July 25th, 1930. (353,696.)

25,168. "Electrical protective relay systems." Associated Electrical Industries, Ltd. August 26th, 1929. (353,732.)

25,600. "Electric supply couplings." Ford Motor Co., Ltd. September 18th, 1929. (353,738.)

26,325. "Electric connection particularly applicable for taking off current." Soc. Anon. le Carbone. November 12th, 1929. (353,748.)

27,197. "Electric switches." M. M. Bock. February 8th, 1930. (353,753.)

27,471. "Junction sleeves or the like for deep-sea cables." Felten & Guilleaume Carlswerke Akt.-Ges. September 19th, 1929. (353,756.)

27,472. "Multipole automatic circuit-breakers." Felten and Guilleaume Carlswerk Akt.-Ges. June 23rd, 1930. (353,757.)

27,788. "Electrical reactance coils." Associated Electrical Industries, Ltd. September 18th, 1929. (353,759.)

31,803. "Voltage regulation of electric supply and transmission systems." W. G. Gold and W. Bayliss, Ltd. October 23rd, 1930. (353,796.)

33,940. "Sleeves for cable and like conductors." Siemens-Schuckertwerke Akt.-Ges. February 19th, 1930. (Addition to 27,953/30.) (353,804.)

38,078. "Electric motor-starting systems." Sunderland Forge and Engineering Co., Ltd., and S. Pfob. December 17th, 1930. (353,816.)

1931

2,580. "Electric signalling systems." H. C. Holmes and Community Radio (1928), Ltd. January 26th, 1931. (353,826.)

8,490. "Transformer coupling systems for wireless signalling." Hazeltine Corporation. February 15th, 1929. (Divided application on 353,447.) (353,423.)

17,253. "Electric switches." T. A. Mills and W. S. B. Bosanquet. April 30th, 1930. (Divided application on 13,326/30.) (353,836.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 12th:—

Crab (lettering and design, the word being enclosed in a tree). No. 501,376. Class 6. Electric dynamos, electromotors, motor-generators, starters for electromotors and motor-generators, and electric transformers.—Crabtree & Co., Ltd., Lincoln Works, Lincoln Road, Walsall.

Torpedo (lettering and design). No. 509,866. Class 6. Magnets, being parts of machinery, &c. No. 569,867. Class 8. Magnets (not for curative purposes).—Turton Bros. & Matthews, Ltd., Wentworth Street, Sheffield.

Westector. No. 524,147. All goods in Class 8.—Westinghouse Brake & Saxby Signal Co., Ltd., 82, York Road, King's Cross, N.1.

Kipp, Delft, Holland (lettering and design). No. 520,839. Class 8. Instruments for measuring electrical quantities or for measuring radiation absorption, colour or turbidity.—Naamlooze Vennootschap Instrument Fabriek en Handel voorheen P. J. Kipp & Zonen, 67-75, Voorstraat, Delft, Holland (British representatives, Frank B. Dehn & Co., 103, Kingsway, W.C.2.).

Leda. No. 524,033. Class 50. Refrigerating chests.—Leda Electric, Ltd., Nelson Street, Miles Platting, Manchester.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberystwyth.—Extensions, Isolation Hospital; J. L. Evans, Cardigan county architect.

Ashford (KENT).—Garage at Station Sorting Office; Contracts Branch, H.M. Office of Works, King Charles Street, S.W.1.

Balderton (NOTTS.).—Welfare centre, Bull Pit Lane, and conversion of Balderton Hall to mental institution; county architect.

Barnet.—Junior school, Underhill (£14,900); Keeble, Ltd., Soho, London.

Bilton (WARWICK).—Children's homes; county architect.

Birmingham.—Extension of Montague Street salvage works; H. S. Evans, architect, 95, Colmore Row. Maternity centres, Warren Farm Road and Trittiford Road; Nichol & Nichol, architects.

Blackpool.—Houses (74), Highfield Road; F. Wood, borough engineer. School, Highfield Road (£48,000); Dr. Ikin, director of education.

Blackwell (DERBYSHIRE).—Houses (80), Pinxton, for the R.D.C.; surveyor.

Bletchingley (SURREY).—Conversion of poor law institution to mental hospital; county architect.

Builth Wells (BRECONSHIRE).—Housing scheme (electrical work) for the U.D.C.; housing architect.

Burnopfield (NEWCASTLE-ON-TYNE).—School (£14,200); J. W. White, Sunderland.

Chertsey.—Conversion of mansion at Botley Park to mental hospital (£4,957); F. & H. Higgs, Ltd., Cobham.

Colchester (ESSEX).—Houses (38) for the T.C.; E. A. Cook and Sons, builders. Dental clinic, Education Offices; Baker and Burton, architects. Church hall, Collingwood Road; John Harrison & Co.

Dalkeith.—Sewage pumping station; G. Thomson & Co., civil engineers, 164, Bath Street, Glasgow, C.2.

Dukinfield (CHESHIRE).—Re-erection of portion of works, Station Street, for Roberts Bros.

Durham.—Schools, Blaydon (£16,000), Birtley (£18,000), Pelton Fell (£14,400), and Cockton Hill (£14,000), for the E.C.; F. Willey, architect, 34, Old Elvet, Durham. Mental hospital accommodation; County Council Special Committee.

East Riding.—Grammar school, Beverley (£27,700), for East Riding E.C.; director of education, Beverley.

Edinburgh.—Two halls, &c., for Leith Wesleyan Methodist Church (£30,000); minister.

Essex.—Enlargement of school, Braintree, for County Council; J. Stuart, architect, County Hall, Chelmsford.

Fair Oak (HANTS).—Hotel; Brickwood & Co., Ltd., Bedford Brewery, Southampton.

Felling-on-Tyne.—Housing schemes, Stoneygate and Pelaw sites, and school and swimming baths, Heworth, for the U.D.C.; J. Hall, architect, Council Buildings, Felling.

Flockton (YORKS.).—Houses (22) for the U.D.C.; surveyor.

Gateshead.—R.C. school (200 places), Dryden Road; Stienlet and Maxwell, architects, 5, Saville Chambers, Newcastle-on-Tyne. Swimming baths for the T.C.; F. H. Patterson, borough surveyor, Municipal Buildings, Swinburne Street.

Greasby (CHESHIRE).—Building estate development; Frankby Hall Estate Co.

Guildford.—Houses (86), Shepherd's Hill, for the T.C.; Guildford and District Guild of Builders, contractors.

Hampden-in-Arden.—Development of Eastcote Lane estate; Edwards, Son & Bigwood, Edmund Street, Birmingham.

Harrogate (YORKS.).—School, Wetherby Lane (£15,050), for the borough E.C.; director of education.

Hartlepool.—Extensions, Henry Smith Secondary School (£3,499); W. Pearson & Son, West Hartlepool.

Haslingden.—Covered market; borough surveyor.

Hertfordshire.—Elementary school, Sandon; county surveyor.

High Wycombe (BUCKS.).—Schools, Mill End Road and Hatters Lane (1,300 places), for the borough E.C.; F. Britnell, secretary.

Kidderminster.—Extensions, King Charles Grammar School; governors.

Knaresborough.—Alterations, Isolation Hospital; Joint Hospital Committee.

Lancashire.—Senior schools, Blackrod and Ulverston; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

Leeds.—Extensions, Sheepscar library (£3,423); J. Pullan and Sons, Ltd. Reconstruction, Cricketers Inn, Dewsbury Road; licensee.

Lincolnshire.—School extensions, Waltham Peaks and Toynton All Saints, for Lindsey E.C.; H. G. Gamble, county architect, Bank Street Chambers, Lincoln.

Matlock.—Houses (36), Starkholmes Road; J. Simpson, architect, Steep Turnpike, Matlock.

Meriden (WARWICK).—Fire and ambulance station, Sumner Road, Coleshill; A. W. Liggins, clerk to R.D.C., 12, Priory Street, Coventry.

Morden.—Clinic, St. Helier estate, for the Surrey C.C.

Newcastle-on-Tyne.—Houses (117) for the City Council; L. G. Roberts, architect, 18, Cloth Market.

Newton-in-Makerfield.—Houses (130); J. Elston, architect, Market Street, Earlestown.

North Riding.—Schools, Whitby (£13,500) and Dormanstown, Redcar, for the county E.C.; director of education, Northallerton.

Northumberland.—Three poor law institutions for the C.C.; W. W. Tasker, county architect, 17, Claremont Place, Newcastle-on-Tyne.

Norwich.—Schools, Mousehold House and Catton Grove housing estates, and Lakenham (£5,723), for the city E.C.; education architect.

Northwich (CHESHIRE).—Hotel, Witton Street; Greenall, Whitley & Co., Ltd., Wilderspool Brewery, Warrington.

Nottingham.—Extensions, Women's Hospital, Peel Street; governors.

Nottinghamshire.—Schools, Sutton-in-Ashfield, Arnold Bentwell, Ollerton, and West Bridgford, and new school block, Skegby, for the county E.C.; education architect, Nottingham. Extensions, Mental Hospital (£32,000); county architect. Extensions, County Sanatorium (£8,199); Henry James, Jun., Mansfield.

Nuneaton.—Municipal offices, Coton Road; Peacock & Bewlay, architects, 83, Colmore Row, Birmingham.

Oldbury (WORCS.).—Houses (28), Birmingham-Wolverhampton Road; J. C. Jones.

Orrell (LANCS.).—Police station (£5,116); county architect.

Ottershaw.—Extensions, Murray House Institution (£11,257); Bunning & Fitton Adams, Ltd., Godalming.

Oxford.—Houses, Cold Arbour (39), for the T.C.; city surveyor. Municipal buildings, Carfax (£25,787); Hinkins and Frewin, builders.

Parkside (DURHAM).—Block for 100 patients, Mental Hospital (£16,000); county architect.

Pendlebury (LANCS.).—Houses (17), Highfield estate, for J. Lane & Sons, Ltd.

Pontefract.—Houses (132) for the T.C.; S. V. Smith, architect.

Preston (LANCS.).—Church (£23,000); Thomas Croft & Sons, Ltd., builders, Blackpool Road.

Prestonpans.—Houses (34), West Loan; R. & A. K. Smith, surveyors, 4, Forres Street, Edinburgh.

Prestwich.—Houses (140), Polefield estate; U.D.C., surveyor, Town Hall.

Reading.—Extensions, Reading school (£15,000), for the borough E.C.; director of education.—Houses (20), Monks Way, Bath Road, for R. J. Haddock, Ltd.

Reigate.—Houses (14) and flats (28) for the T.C.; C. J. Doyle, builder, Croydon.

Rickmansworth.—Extensions, Hill End School (£4,821); T. J. L. Davies, Chalfont St. Peter.

Richmond (SURREY).—Extensions, poor law institution (£2,500); county architect.

Rochester.—Theatre, for a local syndicate; E. Albury, 137, High Street.

Ruthergien (GLASGOW).—Cinema (£15,500) for Burnside Picture House Co.; secretary.

Ryhope (DURHAM).—School (£16,531); D. Glen, Jarrow-on-Tyne.

St. Albans.—Houses (54), Grimston Road, for the T.C.; borough surveyor. Houses (134); Workmen's Housing Association, Ltd.

St. Helen's.—Extension of Sutton Manor Council School; Biram & Fletcher, architects, 17, George Street.

Salford.—Clearance scheme, Greengate area; city engineer. Premises, Islington Street and Chapel Street; Royal Liver Friendly Society.

Sedgefield (DURHAM).—Offices for the County Works Committee and Guardians Committee (£5,000); William J. Merrett, county architect, 43, Old Elvet, Durham.

Shoreham (SUSSEX).—Re-erection of Duke's Cinema, High Street; proprietor.

Skipton.—Maternity hospital; Skipton and District Hospital Committee.

Solihull.—Maternity home, Lode Road; Solihull Nursing Association.

Southend-on-Sea.—School, Thorpe, for the borough E.C.; F. W. Smith, architect, Municipal Buildings.

South Shields.—Boys' secondary school, Harton (550 places), for the E.C. Pit-head baths, Westoe and St. Hilda collieries; Miners' Welfare Committee.

Spenborough (YORKS).—School, Liversedge, for the E.C.; J. H. Linfield, clerk, Cleckheaton.

Staffordshire.—Schools, Uttoxeter, Sedgley, Brierley Hill, Lichfield, North Canes, and Eccleshall; and extensions, Queen Mary's Grammar School, Walsall, and Sedgley Red Hall and Robert Street schools, Sedgley; F. A. Hughes, director of education, county education offices, Stafford. School, Tettenhall (£14,000); A. M. Griffiths & Son, Ltd., builders, Wolverhampton.

Stalybridge.—Rebuilding paper mills, Higher Mill Road; J. Hargreaves, Ltd.

Stockport.—School (£43,676) for the borough E.C.; director of education.

Surrey.—Central schools, Cheam (£23,880), and Hinchley Wood estate, Esher; county architect, Kingston.

Trowbridge (WILTS.).—Re-erection of portion of woollen mills for Samuel Salter, Ltd.

Tynemouth.—Alterations, Turk's Head Hotel, for W. B. Reid, Newcastle; Haswell & Son, architects, 77, Tyne Street, North Shields.

Uckfield (SUSSEX).—Houses (20) for the R.D.C.; T. Burdett, surveyor, Beacon Road, Crowborough.

Wakefield.—Extensions, poor law institution; West Riding county architect.

Warsop (NOTTS.).—Hotel, Pickles Lane and Carter Lane; Chesterfield Brewery Co.

Welwyn.—Infants' school, Salisbury Road (£12,702); Keeble, Ltd., Soho, London.

West Ham.—Additions, Goodmayes Mental Hospital; borough engineer, Town Hall.

Whitby.—Houses (52), Gallows Close; Hays & Gray, architects, Central Chambers, Wingate, Durham.

Whitworth.—Extension of sewage disposal works; W. Foster, 76, Crow Hill North, Middleton.

Worcestershire.—Schools, Upton, Cakemore, Stourbridge, Stourport, Leigh Hurst, and Halesowen, for the county E.C.

York.—School, Clifton Without (£7,525) for the city E.C.; W. Birch & Sons, Ltd., builders.